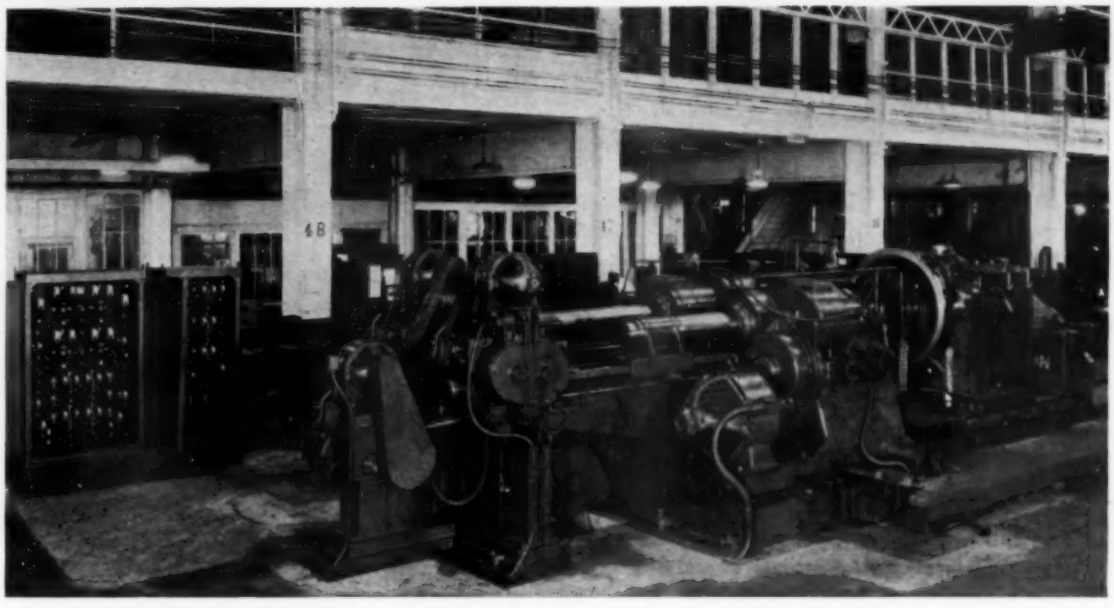
American Machinist

May 23, 1934



A multi-motored special boring machine typical of a case where group drive is impossible

Are You Spending Too Much for Power?

CHESTER B. LORD

Works managers today are having their troubles trying to reconcile a modest profit with higher wages, shorter hours and greater material costs. Economies in machining operations have been given considerable attention and their effect on the selling cost are well understood. But the cost of power has not been given the same careful scrutiny.

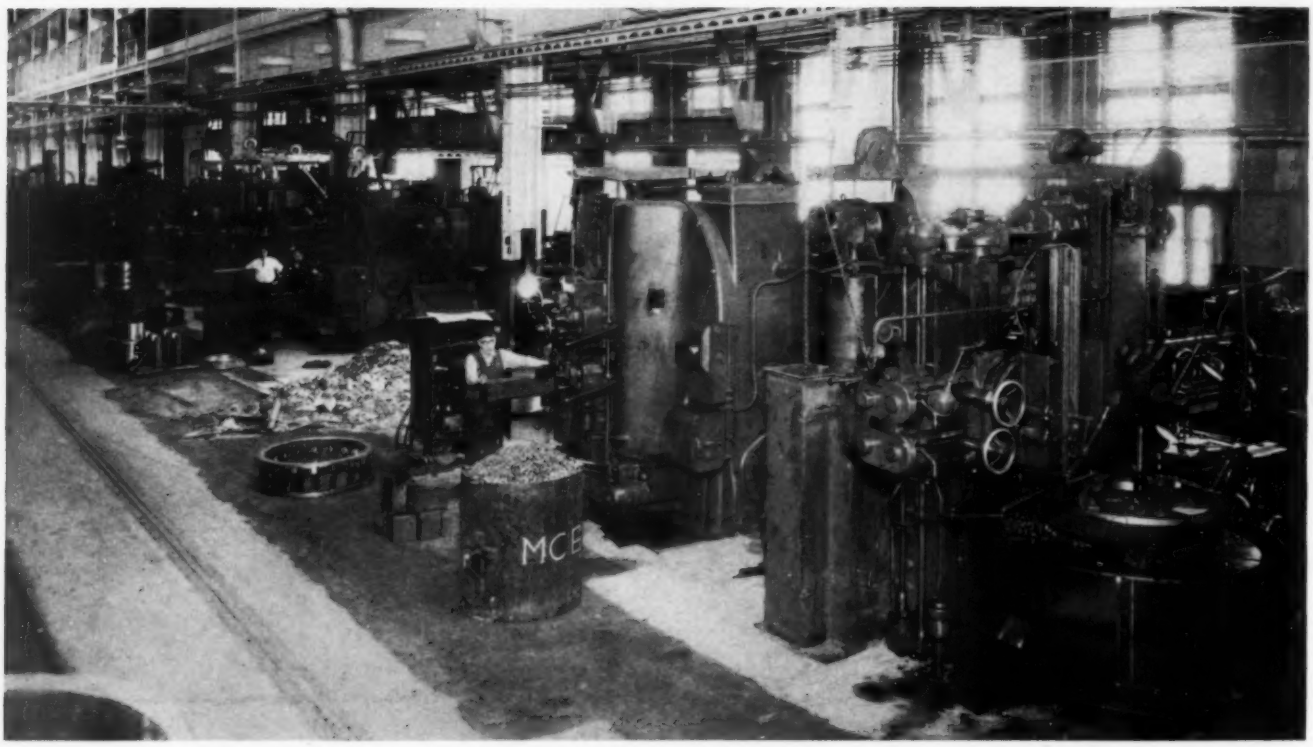
PURCHASED POWER, whether in the form of coal, water, or kilowatt-hours, not resold to the ultimate purchaser represents large, measurable and avoidable waste. Power generation costs have been reduced to what may be the minimum, but power distribution costs are in most cases far above the possible minimum.

Power in the form of electric current has become so much an accepted fact that insufficient attention has been paid to its distribution within the plant. It is no exaggeration to say that one-half of the power cost of the average factory may be saved, not once, but continuously.

"Do it electrically," is quite properly the keynote of the time. The electric motor is an invaluable servant of man. Properly applied to the manufacturing problem it is one of industry's most efficient tools. Improperly applied, it is one of the least efficient.

There is no general problem involved in the use of electric motors or in their installation. There are simply two objectives in order to achieve a third objective. Keep all motors loaded to capacity; use as little current as possible, in the interests of economy. Whether a machine shall be driven by an individual motor or by a countershaft and belt, is not a problem. It is a matter of judgment—usually obviously so. Keeping the motors used loaded to capacity or even reasonably overloaded is a matter of study, and rewards the student in two directions: less current is used, and the power factor is higher.

Power factor is really the basis of payment for current used. There has been much objection to this base on the part of users, because low power factor represents faulty distribution methods, or at times, underloading beyond the control of the user, and he objects to being penalized. In the last analysis,



A line of large machine tools of varying types where group drive is less practical than unit drive

however, the power generating company must receive compensation for "loafing current" either in higher rate or penalty.

Power factor is but one phase of distribution and may be corrected by power factor correction devices. Where direct current is used, power factor does not enter.

Loss in Motor Applications

The second and probably greatest loss of electrical power is in the application of the motors, and the following points should always be in mind:

A large motor is more efficient than a small one.

It is better to overload a motor, within reason, than to underload it.

An inclosed motor is not as efficient as an open one and cannot carry an overload without dangerous overheating.

An open motor can be overloaded 20 per cent indefinitely.

Repairs are less frequent on large motors because they are built more carefully.

For individual drive the machine is usually over-powered for average operating conditions.

For group drive the machines should be underpowered.

With these fundamentals clearly in mind it is only necessary to use mathematics and judgment in order to determine what type of drive is best suited for any machine or group of machines.

There are many machine tools that are d.c. motored and except where the power is exclusively d.c. these machine tools always have unit drive. Large machine tools are practically always unit driven. In the automobile industry many plants are unit driven to facilitate the rearrangement of machines whenever a new model or manufacturing method is introduced, and at least one large contract-type shop uses unit drive for the same reason in relation to new contracts. On the other hand there are many places where group drive will show decided economies in first cost, maintenance and power costs, and it is here that one of the major savings may be made.

Group drive, in its present-day sense, means a carefully planned layout to suit production requirements, with machines run from an anti-friction bearing line shaft in conveniently sized groups.

The main factors entering into the consideration of the use of either method are: first cost, installation cost, maintenance cost and power costs. All these items will usually be higher for unit drive. Exact comparisons are not available, because no large plant, so far as known, has deliberately abandoned one method in favor of the other and kept costs of the turnover. Even if one had changed over it would utilize many of the motors on hand and the costs would not be complete or accurate. Accurate costs, however, are available for each type of installation and the costs of the other method can be estimated with fair accuracy.

In the average plant the first cost of electrical power equipment for unit drive is nearly double the cost of the corresponding group drive. The total annual costs, including fixed charges, are about 30 per cent higher.

Analyzing these first costs we find that 40 hp. in ½-hp. motors costs about $2,700. In 1-hp. motors the cost would be $1,760, and for one 40-hp. motor, we would pay only $313. The control equipment for the 40-hp. motor costs $85, and for 40 1-hp. motors the cost is $3,000. The power cost is greater because the power factor is lower in small motors, and drops off much more rapidly in under-loaded small motors than in large motors under similar conditions, especially as small unit motors must be oversize. In the case of group drive a motor size can be specified that will keep it operating at or near peak power factor.

Open or Inclosed

A further saving is found in the type of motor used. In unit drive where the motor is near the floor or located where chips or fragments of material may fall or be drawn into it, an inclosed type of motor is often installed. An inclosed motor costs about twice as much as an open frame motor of the same rating, and a large inclosed motor must be used because an inclosed motor will not stand overloads. Under ordinary conditions an inclosed motor runs at approximately

50 F. above room temperature and more is not allowable. An open motor under normal full load runs at 40 F. above room temperature and will run with twenty per cent overload without rising above 50 F.

Merits of Large Motors

A large motor is inherently a better made and more rugged mechanism. A large motor has an open slot in the field, and sometimes in both field and armature. The sides of the open slot are parallel from top to bottom, and a preformed coil, properly insulated, impregnated and baked, is placed in the slot without strain or distortion and held immovably in place. In a small motor the slot is of the semi-inclosed type. It has a bottle neck at the top and the coil wires are laid in the slot one by one and when wedged. The frames are sometimes impregnated afterward, but more often not, and even if they are, there are many crossed wires in each leg of each coil that may short or ground Electrical failures, therefore, are much less frequent with large motors than with small. Taking this into consideration as well as the much larger number of motors used in unit drive, we may safely expect four to five times as many failures with unit drive.

Spare motors are another item. Just what proportions of spare motors it is necessary to carry is a matter of opinion and policy, but it must be remembered that no one motor manufacturer's product stands out as being so superior as to induce all machine tool manufacturers to use it, nor is it ever likely to become a matter of trade agreement. There is a possibility, therefore, of each machine tool being equipped with a different make or type of motor. If time is of importance a spare of each type, make and size must be carried. R. W. Drake, an engineer who has given much study to the subject of economical motor drives, gives the following figures for a large industrial plant. (*Maintenance Engineering*, Vol. 90, p. 354.)

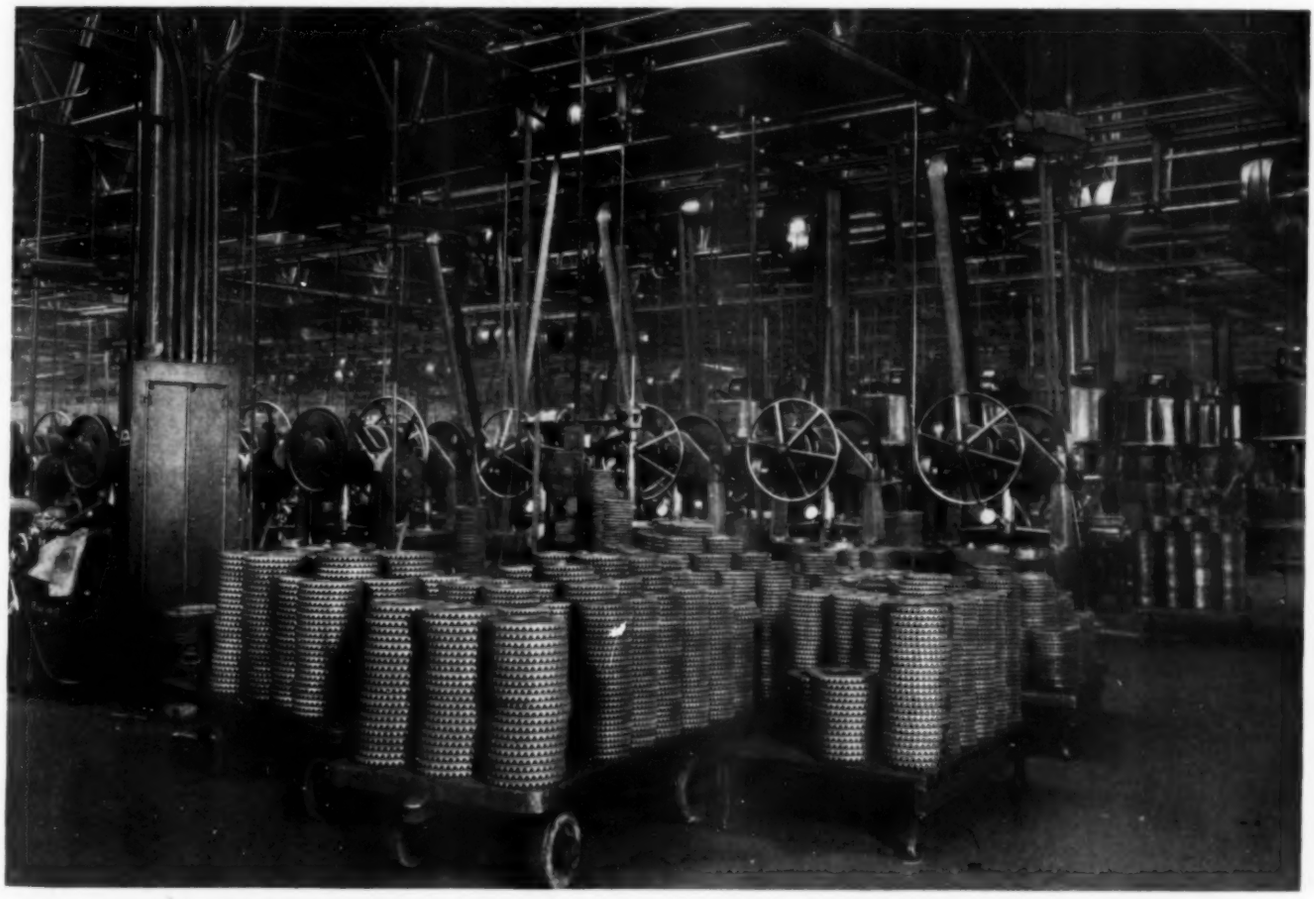
	Group drive	Unit drive
Total number of motors	270	5,200
Spare motors	20	269
Cost of spares	$3,594	$22,000

It might be thought that a standardization of motor sizes or, at least, the use of preferred sizes might cut down the number of spares needed, but where machine tools are purchased with motor installed, the maintenance or plant engineer sometimes has no control over the size of motor used. The natural tendency of the machine tool maker is to install a motor that will pull any cut the machine will take. This condition may be met with rarely, but the machine is over-motored to meet it when it does occur. Sometimes this over-powering may be 100 per cent or more. The load on a machine tool is so variable, because of different feeds, speeds, and materials that the powering is largely a matter of inspired guessing in any event. Instead of over-motoring every individually driven machine, the engineer knows, when he specifies a motor for group drive, that its capacity is greater than the demand on any or several machines can be, and that it is less than the total power requirements of the group. If he guesses wrong, he has to change but a single motor.

Valuable Case Studies

"The Mechanical Power Engineering Associates" are a group of interested engineers and users of power who are giving expert attention to economical machine drive. Here are some case studies made by its members.

The costs in the first case are from



Group drives in a gear plant where the layout is not complicated by conveyors

	Group Drive	Unit Drive	Saving
Total installation cost	$12,496.59	$42,971.86	$30,475.27
Annual operating cost	3,269.08	9,371.78	6,102.70
Operating costs including depreciation, interest, taxes and insurance	1,874.49	6,445.76	4,571.27
Annual maintenance cost	43.68	1,080.00	1,036.32
Power cost	1,350.91	1,846.02	495.11
Power factor	85	59	
Weighted motor efficiency	86.8%	74.3%	

Comparison of Group and Unit Drive Costs

a detailed study of a typical metal-working plant having combined unit and group drive. The unit and group drive as a whole, may be called an improved and modernized group drive. The company in question operated another plant in which unit drive was used throughout, and had found that it could not be operated economically. The two plants were practically identical in size and equipment, and the costs are the actual findings of a power transmission engineer working with the manufacturer's own plant engineers and accountants.

The final cost differences between the two methods of drive are shown in the table above.

Overall Comparison

The product of the plant was small machined parts for a wide variety of metal products.

The machines employed in this work were: 20 automatic screw machines; 2 automatic turret forming machines; 29 hand screw machines; 2 semi-automatic chucking machines; 24 turret lathes; 1 special tapping machine; 1 burring machine; 1 chip separator; 1 blower; and 9 grinders.

The group drives employed nine line shafts 60 ft. long, and three shafts 50 ft. long, and group drive was used on all machines except one automatic screw machine, one burring machine, one chip separator, one blower, and six bench grinders. These machines were unit driven because of infrequent use, large load or location. Anti-friction bearings were used throughout. The quantity of light at the center of these departments varied between 20 and 22 foot-candles.

The wiring cost for group drive was $1,235. That for the unit drive was $2,947.79. The higher wiring cost for unit drive is caused largely by three factors: the greater number of motor circuits, control wiring and motor settings; the larger copper and conduit sizes; and the corresponding increase in installation labor. As a single instance of this: one 25-hp., 3-phase, 440-v. motor required three No. 6 wires in a 1¼-in. conduit. The costs follow:

Wire and conduit installed	$87.10
Pro rata cost of feeders, panels and switchboards	75.31
Installation and connection of motor and compensator	35.00
Total	$197.41

To install the unit drive requiring two 5-hp., eight 3-hp., and two 1-hp. motors, using No. 14 wire in ½-in. conduit cost as follows:

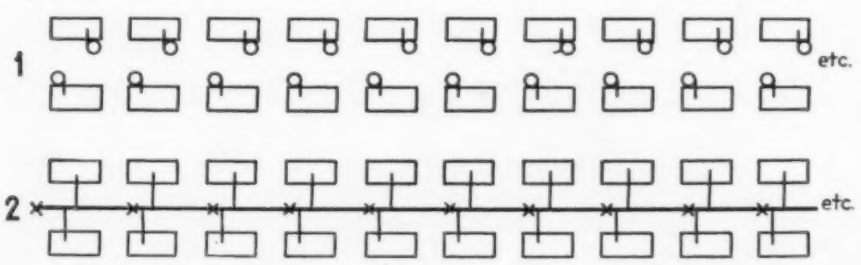
Wire and conduit installed	$470.40
Pro rata cost of feeders, panels and switchboards	333.32
Installation and connection of motors and controllers	154.60
Total	$958.32

The 25-hp. motor has a full load current of 32 amperes. No. 6 wire is plenty heavy for this. The full load of the twelve unit-driven motors amounts to 54.4 amperes and should have No. 5 main feeders. At every turn the unit cost is greater. The same relation of costs obtains in every department.

One More Case

Present Unit Drives
Operating—40 Nut Finishers
Drive Details—shown in Fig. 2

Installed motor hp.	40
Operating hours	5,420
Average motor load	50%
Average motor eff.	75%
Average drive eff.	70%
Average p.f.	55



Diagrams indicating battery arrangements where group drive (2) was more economical than individual drive (1)

Group Drives
Operating—Same Machines
Drive Details—Shown in Fig. 2

Installed motor hp.	20
Operating hours	5,420
Average motor load	100%
Average drive eff.	85%
Average p.f.	93
Average motor eff.	90%

Installation Costs

Unit Drive		Modern Group Drive	
Motors and control	$2,680	Motor and control	$272
Wiring	2,100	Wiring	278
Drives	600	Drives	900
	$5,380		$1,450

Operating Costs

Unit Drive		Modern Group Drive	
Fixed charges 15% =	$807	Fixed charges 15% =	$217
Maintenance		Maintenance	
40 motors		2 motors	
40 controls		2 controls	
40 drives		42 drives	
80 bearings		26 bearings	
200 items		72 items	
Power	2,646	Power	1,758
Total	$3,453	Total	$1,975

Power Computation

$40 \times 0.50 = 20$ hp. output

$\frac{20}{.75} = 26.6$ hp. input

$26.6 \times .746 = 19.7$ kw.

$106{,}774 \times 0.70 = 74{,}731$ kw.-hr. machine consumption

$\frac{74{,}731}{.85} = 87{,}900$ kw.-hr. M.G.D. consumption

$19.7 \times 5420 = 106{,}774$ kw.-hr.

@2c. = $2,134

@2c. = $1,758 G. D. power cost.

P.F. charge 0.24 = $512

Unit drive power cost, $2,646

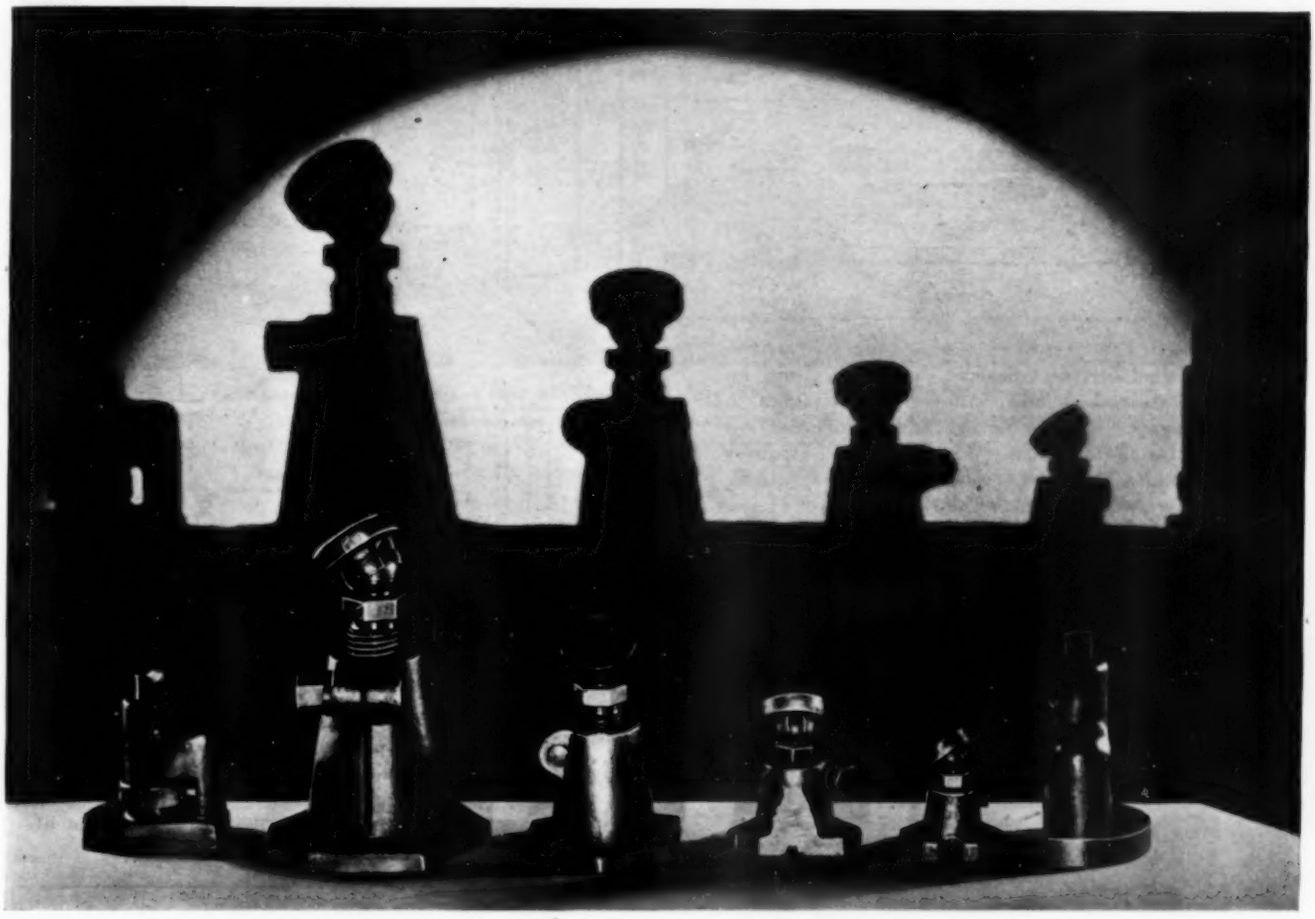
Annual Saving through Use of Group Drives, $1,478

The saving shown by employing group drive, while it is clearly advantageous, does not constitute a sufficient sum to save an industry, and may make but a few per cent difference in the year's operations, but a few per cent is sometimes the difference between successful operation and loss.

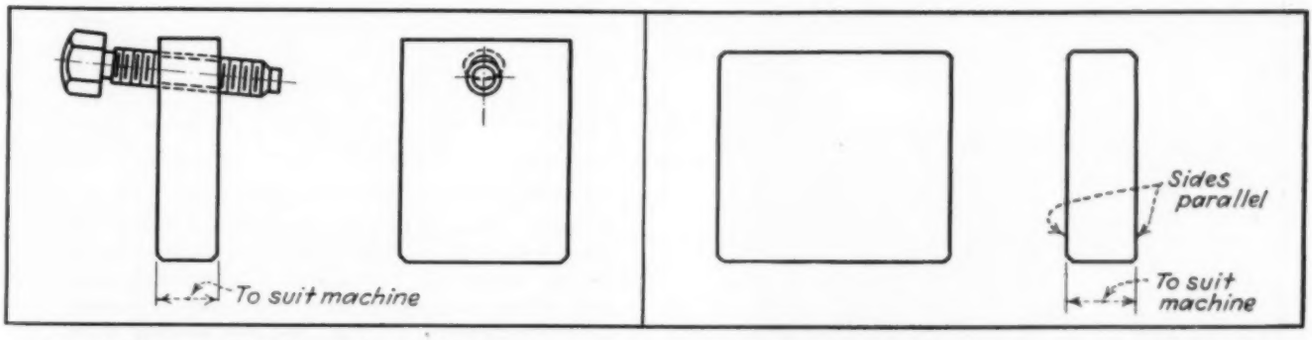
The foregoing discussion treats of the advantages of group drives from the economy angle. On the other hand, there are plenty of instances where economy is not so important as flexibility of layout, or appearance of the shop, or some other consideration. The trend of the times has been toward individual drive, sometimes apparently regardless of expense. No standardized answer can be given to the question whether to use individual motors or group drives, but certainly it will pay to make an engineering analysis of both before deciding on either.

Standard Tooling Equipment Simplifies Small-Lot Manufacture

F. S. CULBERTSON
In Charge of Tool Design, Cincinnati Milling Machine and Cincinnati Grinders Inc.



A jack of the proper size is essential to support projecting sections of irregular pieces so that the pressure of the clamps will not distort the work. Heights vary from 1 in. to 18 in. or more. Locking screws and swivel or V-shaped tops are standard.



Slot block stops differ from slot blocks in having a tapped hole and an adjusting screw. Especially useful for aligning rough work on a machine table where one end must be shifted more than the other, they may also be used to hold work against another block by inserting a filler block

Hardened slot blocks are made to fit table T-slots so exactly that they can be slipped in by hand. They set square with the table without shake. They are used singly as stops, or in pairs to square or align longer work with the table when a finished surface is presented

IN ANY SHOP where small lots of pieces of irregular shape are to be machined the problem of holding them rigidly but without distortion during machining operations is a real one. The complete equipment of standard tools for this purpose assembled by Cincinnati Milling Machine and Cincinnati Grinders Incorporated has been an important factor in facilitating shop operations and in reducing costs. The illustrations on this spread and the preceding page show details of the various units involved, and an actual set-up.

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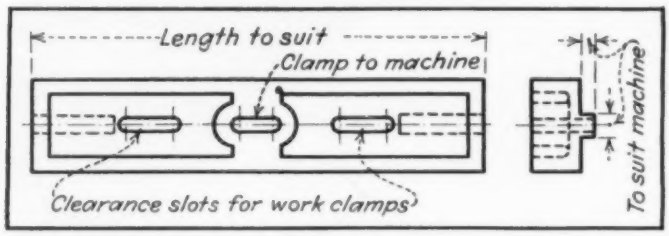
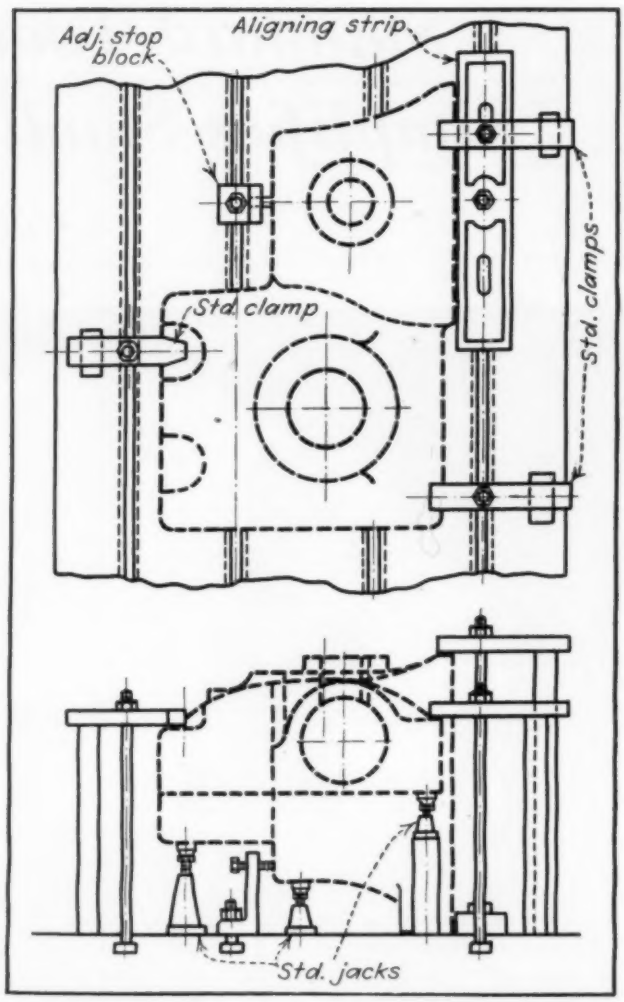
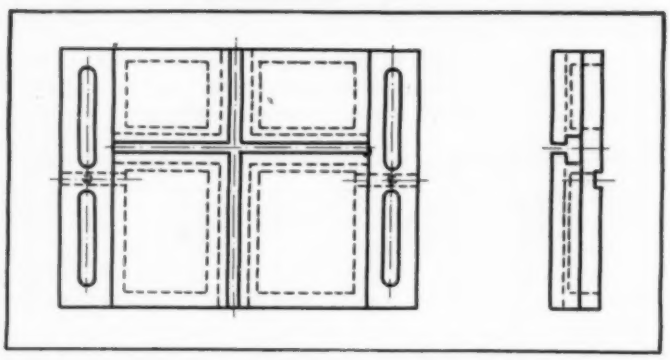


Aligning strips are used for locating long work which has a finished surface. Several short pieces may be located against them and clamped to the table. A tongue engages the slot in the table and holes are provided for T-slot bolts. Where unusual accuracy is demanded a light cut is taken across the face of the strip before the work is set up

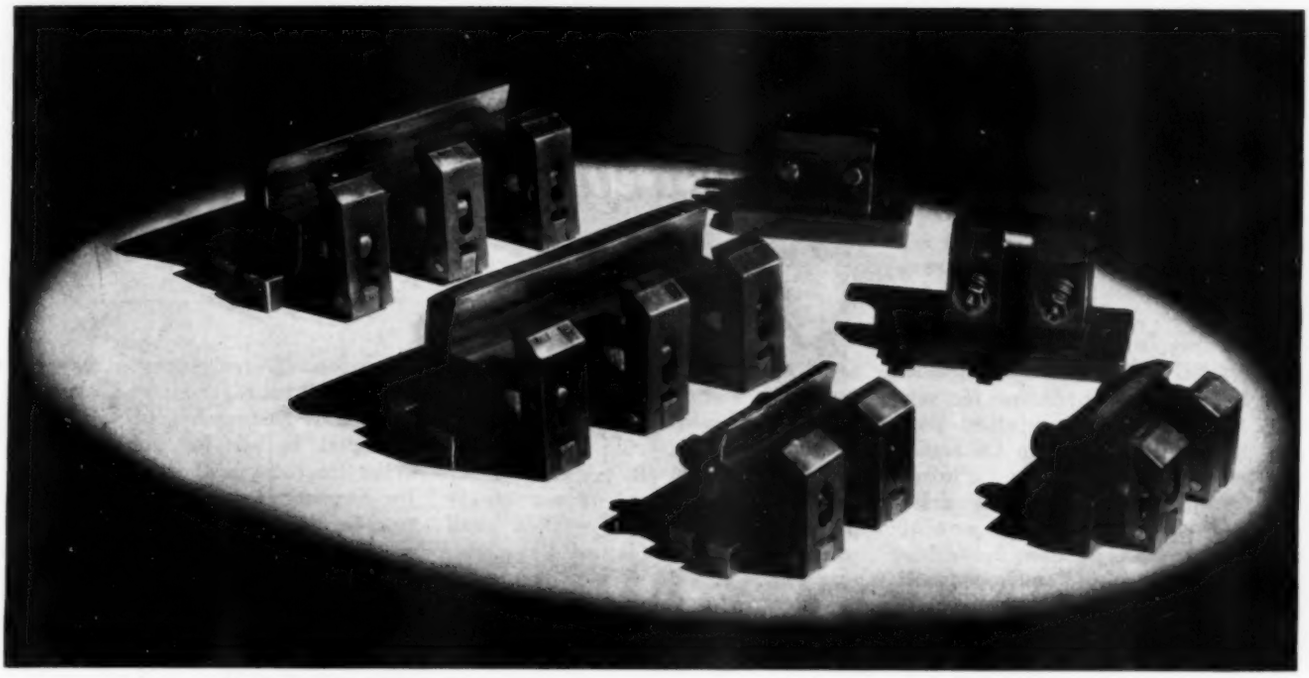


Typical set-up of an irregular piece showing the use of several of the standard units. Each jack must be as nearly under the clamp as possible, and the stops must be opposite clamping screws. It is always well to locate jacks and clamps so that a rigid section of the casting is directly between them



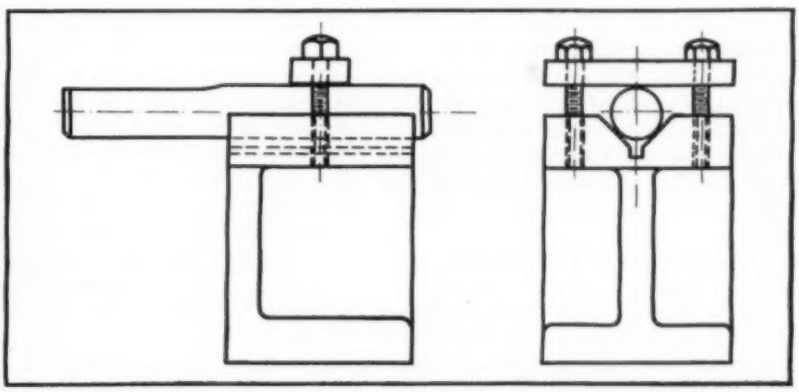
Squaring plates, of thin cast iron, have a tongue slot beneath to fit to the table and two T-slots on top at 90 deg. as shown. They are used for locating small parts where subsequent operations require turning the piece through 90 deg., and for locating small fixtures where the same procedure is involved

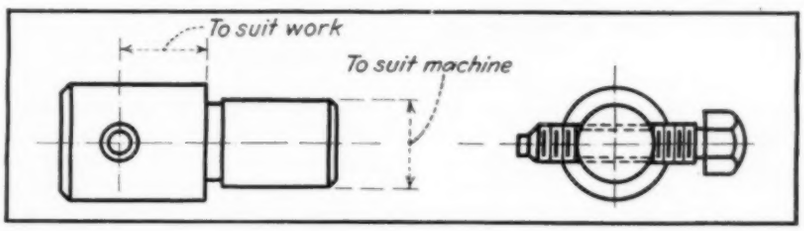
The display board illustrated gives a good idea of the range of lengths and sizes of T-bolts, heels, and standard clamps. T-bolts are either $\frac{5}{8}$ in. or $\frac{3}{4}$ in. in diameter; flat clamps $2\frac{1}{2}$ in. wide by $\frac{3}{4}$ in. thick



Shaft jigs of various sizes, as illustrated, are useful for holding such work as shafting, bushings, etc., while milling keyways, flats or slots in the ends or along the sides, or for drilling. Made either of castings or welded steel they grip the work in a V-clamp and are provided with slotted lugs for T-bolts

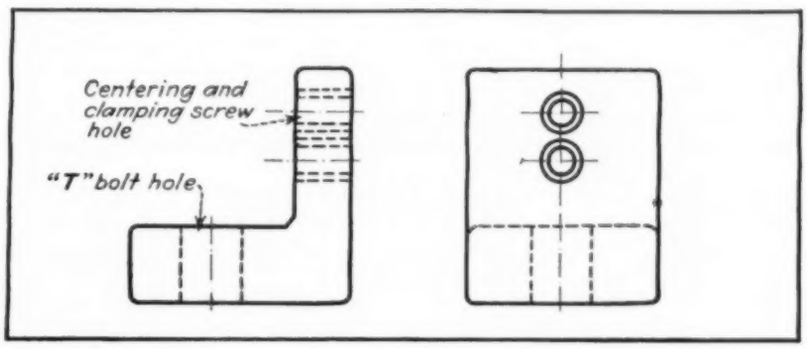
***Right*—The V-stand, with its series of studs of various diameters, is used where holes for setscrews or oil leads must be drilled or tapped in pulleys, gears, sheaves, etc. The top of the stud is flattened to clear the burr left by the drill or tap when the work is removed. The stand is high enough to hold large work clear of the table**





Planer stops are in general use, of course, but they are shown here to indicate the necessity of including them in the tool list wherever any sort of machine table or plate has been drilled and reamed for them

Angular stops, originally made for a boring mill set-up, are equally useful elsewhere. They are made of steel and the number of clamping screw holes is optional. The bolt hole is for the table T-bolt



Spring Collets Finished by Grinding

FRED B. JACOBS

SPRING COLLETS for precision lathes have been in use for more than half a century; they probably had their inception in the watch-tool industry. Today, their use in machine shops and toolrooms is almost universal, since they afford a ready means for accurately holding finished bar stock, such as drill rod and round cold-rolled steel. Manufacture of collets, whether in small lots or in large quantities for distribution to the trade, presents several grinding problems that are outlined in this article. Regardless of whether few or many collets are to be made, special grinding appliances are necessary to promote accuracy.

A typical collet of standard design is illustrated in Fig. 1. While the hole is for ½-in. stock, the other dimensions are standard. Thus, in cases where collets are made in quantities, it is an excellent plan to make the blanks in turret lathes. The blanks can be stocked as semi-finished parts to be finished as occasion requires.

Sequence of Operations

Spring collets should be made of tool steel, spring tempered. The first grinding operation is to rough grind the bore. A special fixture for the internal grinder is used, as shown in Fig. 2. A production grinder will handle the work nicely, but if such a machine is not available, a universal grinder set up for internal grinding can be used. The fixture consists of the cast-iron body *A*, screwed to the spindle nose; the work locating bushing *B*, which is of hardened steel; and the draw-in rod *C*.

As the collet is drawn back it is obvious that it will contract. To overcome this, a ring should be attached to the outer end by sweating, as at *D*. A number of these rings can be provided and they can be used over and over again. About 0.020 in. should be allowed for grinding a ½-in. hole, and in rough grinding about 0.010 in. should be removed. This will leave 0.010 in. for finish grinding, which may appear liberal, but the reason will be explained later on.

The wheel for this operation should be of manufactured abrasive of a comparatively coarse grit, about 36, while the grade should be from medium to medium soft. It should run at a surface speed of 5,000 ft. per min. However, such high speed is not always possible to attain with such a small wheel. For example, it would be necessary to run a ½-in. wheel at more than 38,000 r.p.m. to attain a surface speed of 5,000 ft. per min. For this reason, lower surface speeds must often be used.

Rough grinding the outside diameter is the next operation. This is done in a universal grinder so that both the tapered and the straight portions can be ground at one setting of the work. The collet is mounted on a special mandrel, as shown in Fig. 3. The small diameter of the mandrel is a push fit in the hole previously ground, and the large diameter is tapered slightly to fit snugly in the back end of the collet. Where large quantities of collets are to be finished, it pays to rough grind with a coarse wheel and to finish with a finer one. In such cases the roughing wheel can be 36 grit, medium-soft grade and operated at 5,000 surface ft. per min. While it is true that higher wheel speeds are used for the general run of production grinding, not all universal grinders can be operated at such a high speed.

Approximately, 0.020 in. should be removed in roughing. The wheel bed is set over to generate the required angle and the angular portion of the collet is ground by feeding the wheel at that angle. The wheel spindle remains parallel with the work and one corner of the wheel is dressed to the angle to be ground. The straight portion of the collet is then ground by traversing the work. Since the two surfaces are ground at one setting, it is obvious that they will be concentric.

Ring Prevents Springing

After the collet has been rough ground, it should be heated just enough to soften the solder for holding the ring, *D* Fig. 1, in place. When the solder softens, any strains that have been released by removing the scale will adjust themselves. The collet may either spring open or shut a slight amount. It is for this reason that such a liberal amount of metal is left for finish grinding. When the collet is allowed to cool with the ring in place, it is obvious that it can be finish ground accurately with assurance that it will not be sprung from either its true shape or from the required dimensions. Since the collet may spring either way, it may be necessary to have several mandrels having diameters varying at the small ends.

Finish grinding the outer diameter is the next operation. If different wheels are to be used for roughing and finishing, the finishing wheel can be 60 grit and medium-soft grade. If, however, one wheel is to be used for both roughing and finishing, it should be as fine as 60 grit. The finishing operation on the outer diameter does not differ from the roughing operation just described.

In Fig. 4 is illustrated the internal grinding fixture for finish grinding the hole. It consists of the faceplate *A*, which is screwed to the spindle nose of the grinder; the outer part *B*, which is secured to the faceplate by three bolts; and the hardened and ground bushing *C* in which the collet is located. The collet is drawn back into position with the draw-in rod *D*, which is screwed over the end.

Insuring Concentricity

Since both the bore and the outer diameter of the collet must be accurately concentric, it is generally necessary to true up the fixture, using an indicator and taking readings from the ground surfaces *F* while the fixture is revolved slowly. If the adjustable part of the fixture does not run true, the bolts are loosened slightly and the fixture is lightly tapped with a lead hammer until a true reading results. If the outer end of the fixture runs out more than does the inner end, it generally means that dirt or burrs are between the hub of the faceplate and its seat against the shoulder of the spindle nose. This must be remedied before grinding. With true indicator readings at both surfaces, the fixture will produce true work.

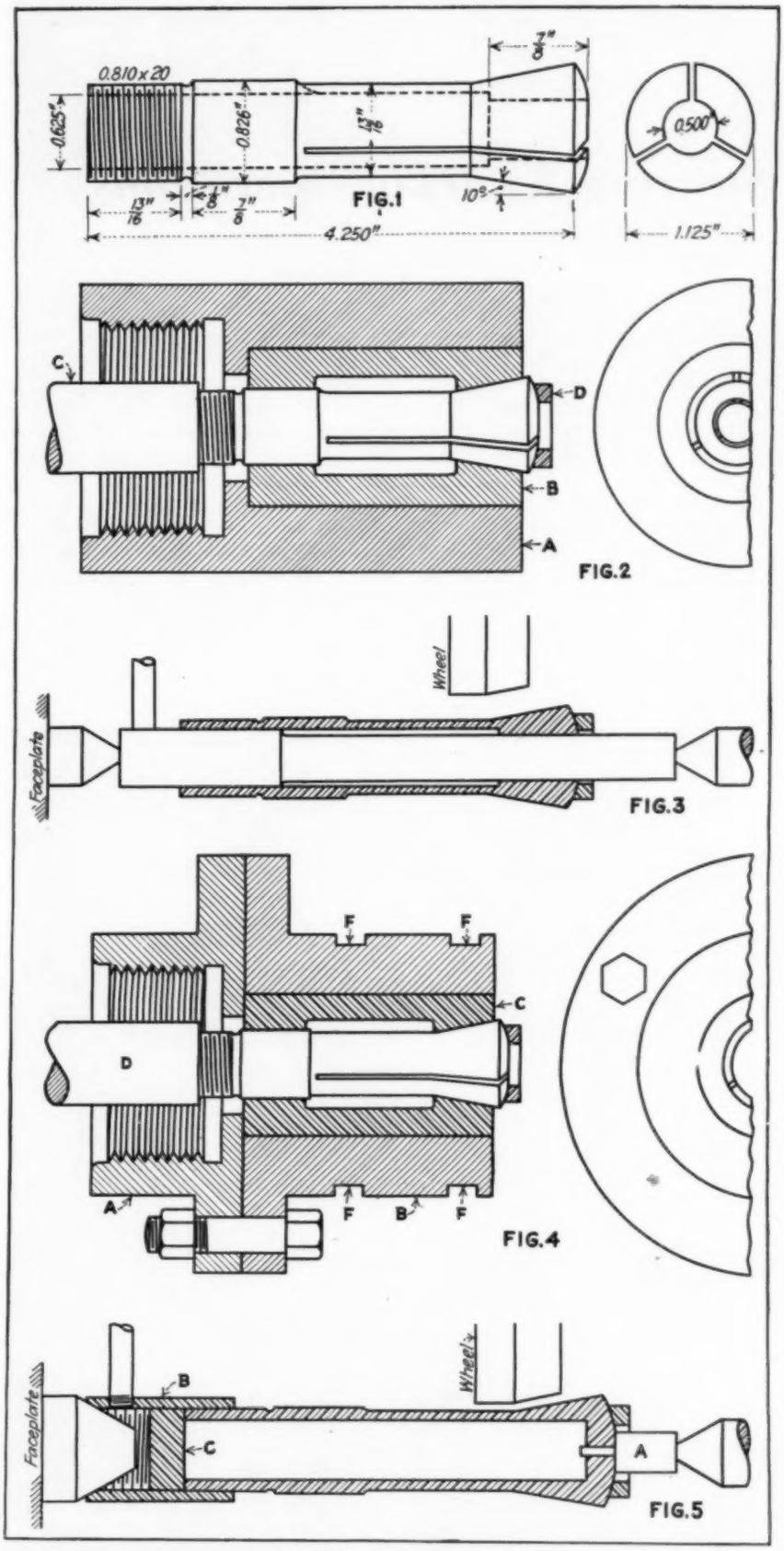


Fig. 1—A typical spring collet of standard design. Fig. 2—Fixture for rough grinding the hole. Fig. 3—Rough grinding the outside. The taper and the straight portion are ground at the same setting. Fig. 4—Fixture for grinding the hole. Fig. 5—Set-up for grinding the outside of a collet having a very small hole

The wheel for grinding the bore should be about 80 grit in a soft grade and should run at about 5,000 surface ft. per min. If this speed is not possible, then a harder wheel must be used. It is, of course, impossible to grind very small holes by the method outlined above. If the hole is very small, a set-up such as is shown in Fig. 5 should be employed for grinding the outer diameter. The hole in the collet is first lapped just enough to remove the hardening scale and a center plug, as at *A*, is inserted. This plug should be a light, drive fit. The collar *B* is screwed over the back end of the collet and is held securely by the screw plug *C*.

For grinding the hole, the center plug is removed and the grinding is done with either a small wheel mounted on a slim shank, or with a diamond lap. A diamond lap is simply a steel lap charged with medium-grit diamond dust by rolling it between two plates on which the diamond dust has been sprinkled. Care must be exercised in using a diamond lap because too much pressure will tear the abrasive from it. The operation of lapping is necessarily somewhat slow, but for holes 1/8 in. in diameter or smaller it is not always possible to find grinding wheels.

After the hole has been ground, or lapped, to size, the last operation consists of removing the ring that has been sweated in place. The nose of the collet is polished with abrasive cloth, the work being performed in a bench lathe in which the collet fits.

Watch Special Departments

Special departments have a way of growing until they stick out in the way, much like a bunion on your toe joint. Every shop must have a toolroom, or thinks it must. This refers to toolrooms that make tools and fixtures, not toolcribs that deal them out to the men. In many cases shops kid themselves into believing they can make standard tools for less money than it costs to buy them. The men in the toolroom naturally nurse this idea along and build up as large a toolroom as possible. When a rush comes they expand rapidly. After the rush is over they hate to deflate, and so go outside for work, frequently cutting prices below shops whose sole business is the making of tools. Bookkeeping profits are easy if you switch overhead costs that belong to this department to regular product. Much of our unfair competition comes from departments of this kind. This crops up either in bids on their own work, or in some cases, where they go outside for work.

Three Chrysler Steering Knuckle Operations

HOLDING WORK on drums that permit access from both sides has become popular for drilling as well as for milling operations. A good example of the drum-type drilling machine is seen in Fig. 1, where steering knuckles are being drilled and reamed in banks of three.

The work is loaded in front, the three knuckles being held by the swinging clamp shown. The drum moves down and brings the work in line with the lower set of spindles, which drill the preliminary hole. The drills in the second bank of spindles at the back enlarge the holes, leaving a reaming allowance. Reamers in the upper spindles finish the job so far as this machine is concerned. The final line reaming is done on another machine.

Both ends of the steering knuckle are drilled at the same time by similar drills and reamers at the other end of the machine. Ample tool lubrication is provided by the pipes shown.

The other holes in these steering knuckles, by which the brake drums and other mechanisms are attached, are drilled in the special, six-station machine in Fig. 2. Each drilling head is individually driven by its own motor, which is so geared as to give the speed required for its work. The motor-driven drillheads carry spindles arranged as needed and driven by cluster gears.

Table Indexes Automatically

All six drillheads have hydraulic feed which is synchronized with the table indexing mechanism. The table indexes automatically after all the drillheads have completed their operations and returned to the starting position. Safety control prevents table movement until all heads have completed the cycle.

Steering knuckles come to the machine on the inclined rack at the rear, this rack being made up of angles. The operator picks the pieces out of the rack and loads the work fixture while it is between the ends of the curved coolant pipe that supplies all six banks of drills. The machine is compact and keeps the work flowing toward the assembly line. It will be noted that spare drills are kept in convenient trays fastened to the drillheads. This saves time when drills become dull or break, and helps to minimize the idle time of the machine. The drilled knuckles are placed in the rack at the left and slide to the next station.

Following the drilling the knuckles go to the new DeVlieg miller, Fig. 3. This machine uses standard bed, table and feed units and has two motor-driven milling units mounted at the rear. Two milling fixtures are provided for each spindle so that each head can be milling a knuckle while two more pieces are being loaded into the other fixtures. Alternating movements of the table mill first one pair and then the other.

Two motors drive the feed unit, one being for rapid traverse. The feed motor is compound wound and has two speeds. Fast feed is used until the cutters approach the bottom of the cut, when the feed automatically drops to the slow rate while the bottom of the knuckle is being milled. The feeds are stopped at the desired point by a remote control mechanism that secures accurate results. These examples are from the New Castle, Ind., plant.

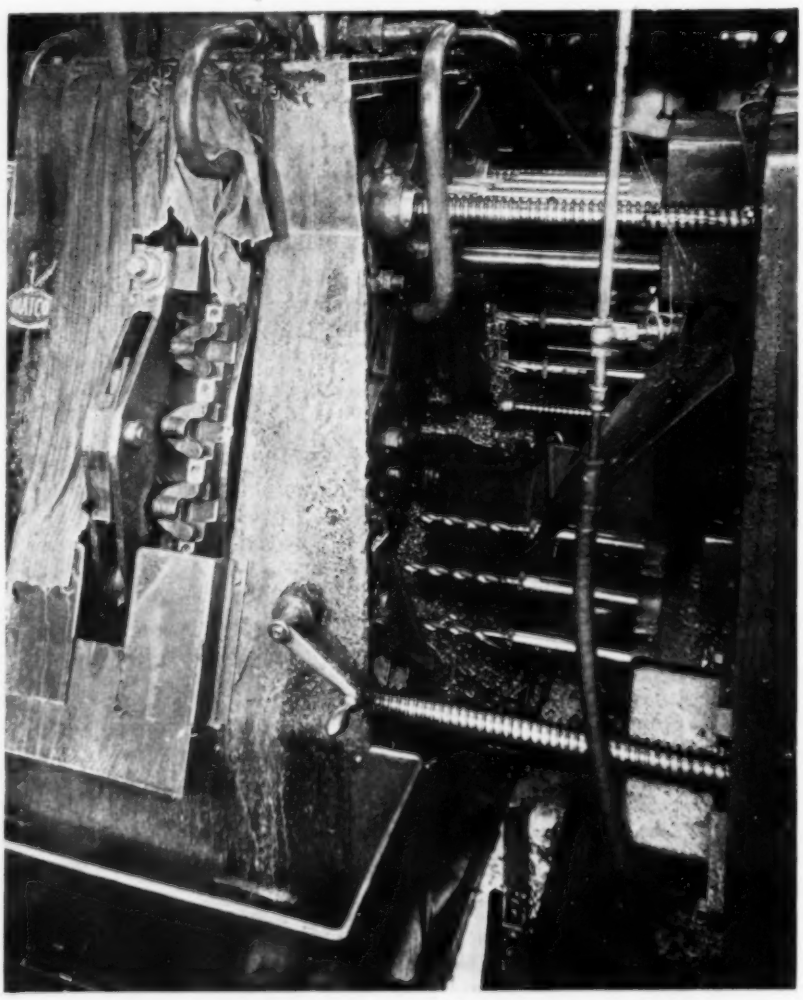


Fig. 1—Drum-type drilling machine with three groups of drill spindles and a loading station. Three steering knuckles are drilled at once

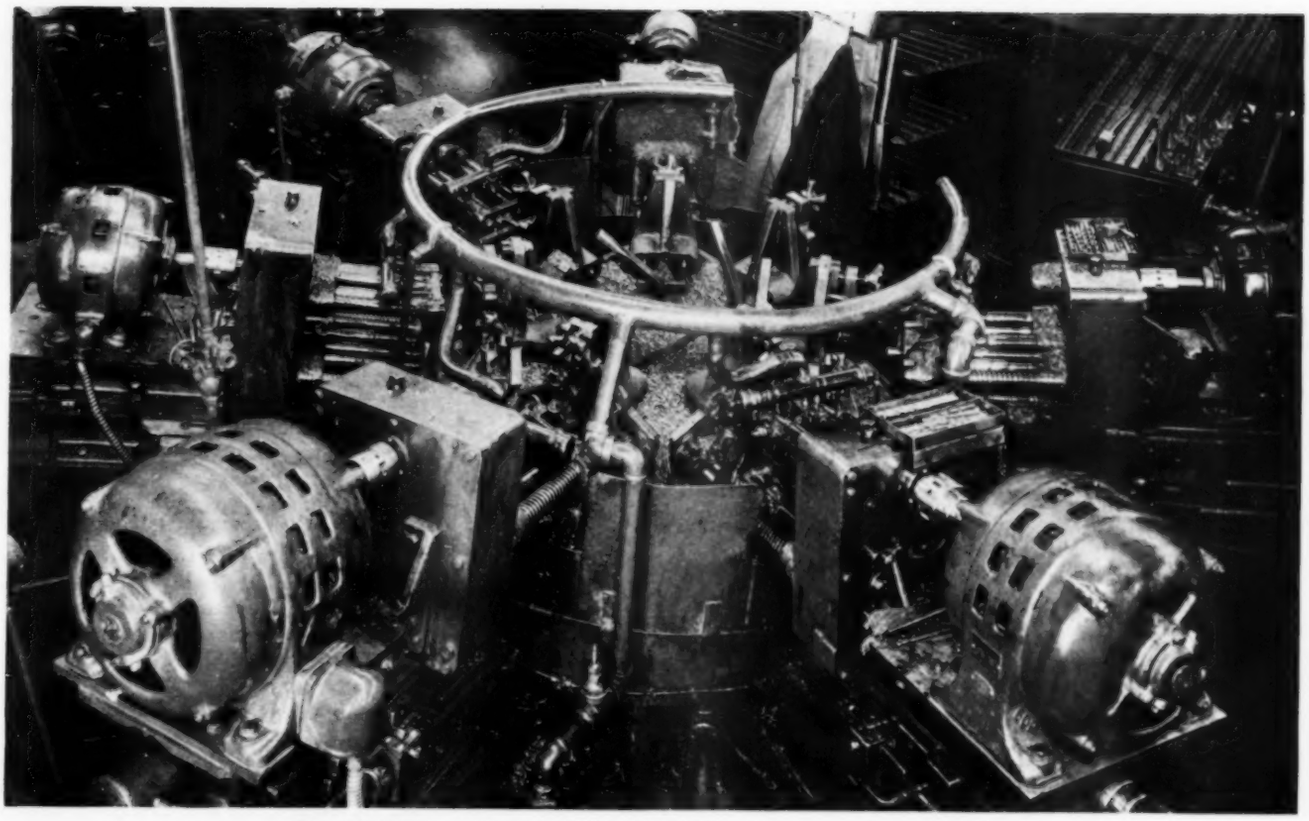


Fig. 2—Each of the six drilling heads has its own motor and independent hydraulic feed synchronized with the indexing mechanism

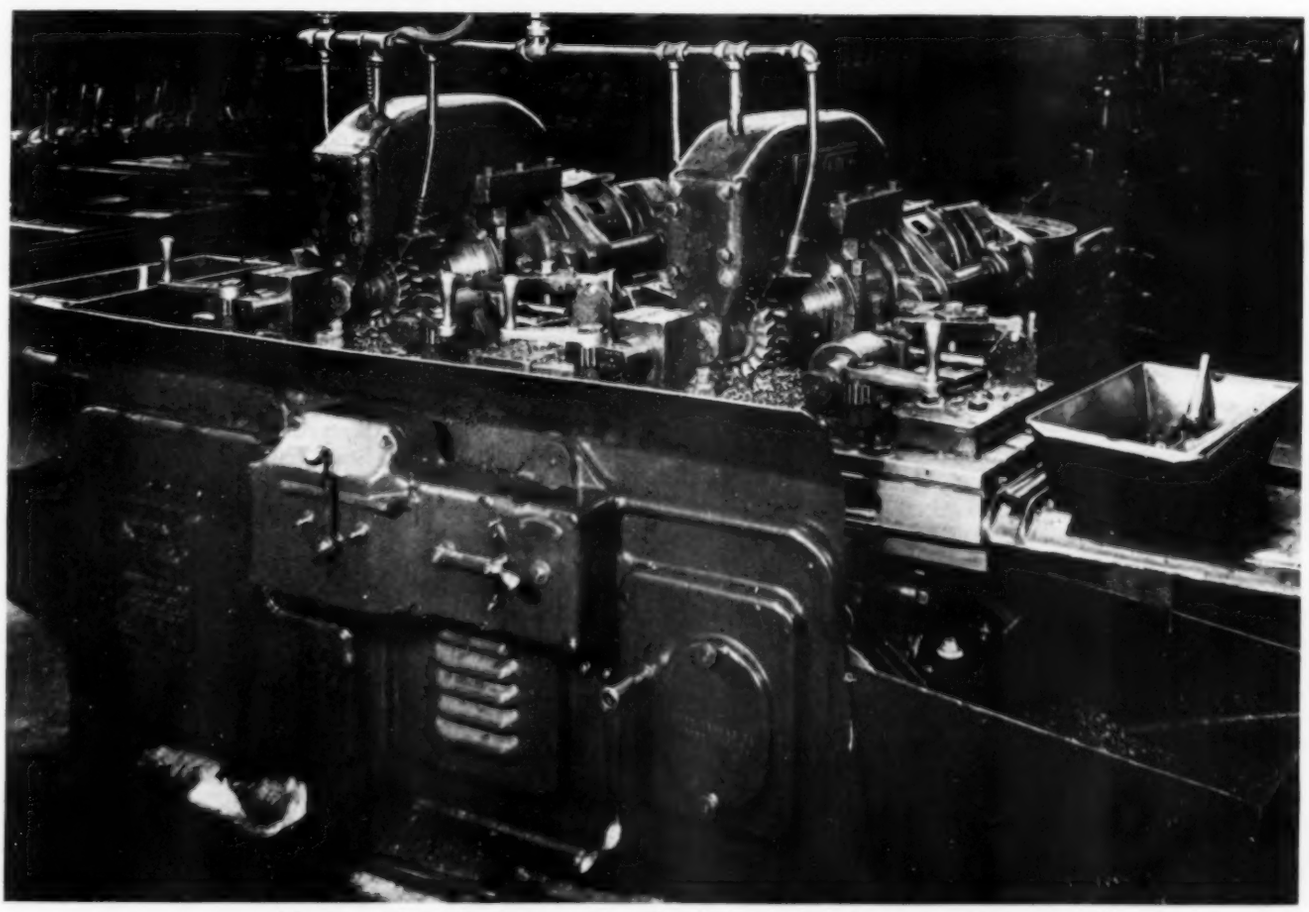


Fig. 3—Independent motor-driven heads are mounted on a standard bed with regular table and feed units which automatically vary the rate

Steels for Heat-Treated Gearing

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What steel and what heat-treatment should be used to meet the demands for increasing loads and speeds in gearing? This is a problem that continually faces a gear jobbing shop. Innumerable combinations of steels and treatments are available. The author tells what can be done with plain carbon steels and what are the advantages of various alloying elements

INFORMATION regarding the suitability of different steels and treatments for various requirements is meager and conflicting. It is unfortunate that manufacturers of steel have left so much of the development, regarding the suitability of their products for different applications, to the users. Generalities, such as, "increased toughness," "shock resistant," are misleading for they do not tell the entire story and are, more often than not, conclusions rather than the results of actual tests.

It is, therefore, up to the gear manufacturer to obtain his own data, either by observing the performance of a chosen material in the field, from the experience of others or by conducting tests and laboratory investigations. In direct contrast to the automotive industry, a gear jobbing shop seldom has sufficient quantities of any one item to justify experimentation to determine the best steel or heat-treatment for an application. A selection is made based on the background of previous experience from similar applications and the results of tests conducted for the purposes of determining the characteristics of the different steels with respect to the various services which they are called upon to perform. Such tests must be carried on constantly, not only for the purpose of determining the characteristics of steels in common use, for which complete and exact data is lacking, but also on new developments.

Very often customers pay far more than necessary for their gears, either because sufficient data on the application is lacking and the supplier furnishes a gear of the highest quality rather than take a chance on failure, or else, absurd specifications are laid down by the customer.

In the analysis of any given application the three principal considerations affecting the selection of the steel and its heat-treatment are the duty which the gears must perform, the conditions under which they operate and the design of the gear itself.

The duty which the gears must perform is comprised of the loads which they carry and the speed at which they operate. The loads may be light or heavy, steady or pulsating, and the service may be continuous, intermittent, reversing or in the form of shock loads or impacts. The speed may be high or low.

The characteristics of the prime mover, which may be a motor, gas engine or steam engine are of the utmost importance in determining what the loads are to be. The connected or driven apparatus must, of course, be considered for it governs certain types of loads, such as vibration and shocks, which may not be transmitted to the motor because of the use of flexible couplings or belt drives.

Heavy loads require steels that can be heat-treated to obtain great strength, whereas shock loads require a high degree of toughness. Pulsating loads, as well as high speeds with the accompanying repetition of impacts, necessitate a high endurance limit in order to avoid fatigue failures. Heavy loads, as well as extremely high speeds, require hard and wear resisting materials which must be frequently tough and shock resisting. High impact values and toughness are necessary for quickly reversed and suddenly started drives.

The conditions under which the gears must function properly are almost as important as the loads themselves. The most important are: the mounting of the gears, the lubrication and the efficiency of the maintenance.

Where the loads are indeterminate, because of misalignment or other causes, steels, treated to obtain the highest degree of strength and toughness, are indicated. Similarly, where the state of lubrication is uncertain or negative, the surface must be hard and tenacious in order to resist the abrasive wear.

When quenched, steels have an unfortunate but unpreventable tendency to distort in some manner or other—a highly undesirable thing for most applications. In general, unsymmetrical shapes, thin sections adjacent to heavy masses, large areas of thin sections and poor proportions, are potential causes of distortion, and sometimes, cracking at quenching. If such conditions are unavoidable, steels which have a low degree of distortion, or which will give suitable properties with a quench less drastic than usual, should be used.

Quality to Meet Demands

The qualities which a steel should possess, in order to meet successfully the various service demands and manufacturing requirements, listed in the order of their importance, are as follows:

1. Ability to withstand wear,
2. Strength,
3. Static toughness,
4. Impact toughness,
5. Low amount of distortion,
6. Ease of machinability,
7. Susceptibility to and ease of heat-treatment.

These qualities must be determined, or rather judged, from the known properties or characteristics of the steel which have been determined by test or from previous experience. A discussion of how the engineer interprets the known data of the properties and characteristics in judging the qualities to be obtained, follows.

1. Listing the ability to resist wear as being of primary importance may seem strange. However, the reason is apparent when it is considered that properly designed and correctly treated gears

Abstracted from a paper presented at the eighteenth annual meeting of the American Gear Manufacturers Association, at Wilkinsburg, Pa., May 4, 1934.

give far less trouble from tooth breakage than from rapid wear, and that, unlike some of the other service conditions, which may or may not be present, all gears are subject to wear. Then too, the fact that so little is known regarding the relative wearing qualities of the different heat-treated steels makes it of utmost importance.

Tests have been made to determine the wearing qualities of treated steels, but the results are held to be inapplicable to gears. In the first place, most wear tests have been made with abrasives in order to expedite testing; and secondly, no wear-testing machine yet made even approximates the combined rolling and sliding action of gear teeth in action. Tests with gears have been made; but in a sporadic manner, generally by different companies, and the reported results, because of the lack of a common measuring-stick, are hardly comparable.

Hardness vs. Tenaciousness

Most metallurgical authorities agree that tenaciousness, as well as hardness, are required for wear resistance. Just what tenacity is and how to measure it is another question. In the author's opinion it is a function of the toughness, grain size and structure, which all affect, to a greater or lesser extent, the hardness as measured by the conventional methods. As toughness has not been clearly defined, particularly as regards its effect on wearing qualities, it is difficult to state from any of the hardness tests whether or not the steel will wear well.

The following definitions of hardness have been suggested:

a. Elastic hardness as measured by the sclerescope;

b. Tensile hardness as measured by any indentation machine;

c. Abrasive or cutting hardness as measured by scratch test.

It would seem that heat-treated steels which give the highest hardnesses as measured by Tests (b) and (c) should wear the best.

Comparing the results of these tests with a microscopic examination of the surface of the steel has given excellent results. In general, it may be stated that steels having a high surface hardness and a fine grained structure, as shown by the microscope, will wear well.

2. High strength in gear steels is a desirable feature, not only because it indicates the static load that can be carried without failure, but also because it is a measure of the fatigue strength or endurance limit. The endurance limit is the capacity of the steel to withstand repeated stresses or complete reversals of stress (which are characteristics of all gear tooth loads) without failure.

Contrary to popular opinion, the endurance limit does not vary with the composition of the steel, but only with the ultimate strength. The ultimate strength itself varies only with the hardness of the steel which is purely a function of the carbon content and heat treatment. For instance: An oil-quenched, alloy steel might have the same hardness as a water-quenched, plain carbon steel of the same carbon content. Similarly: A low carbon content, oil-quenched, alloy steel might have the same hardness as a higher carbon content, oil-quenched, plain carbon steel. For the same hardness, any of these four steels will have, within close limits, the same ultimate tensile strength and endurance limit. The endurance limit for treated steels, having a martensitic structure, will be 40 per cent of the ultimate tensile strength, whereas for a pearlitic structure, it will be 45 per cent. This applies to polished plain test specimens only. The values will vary if there are stress concentrations caused by grooves or fillets.

3. Static toughness is the ability to withstand loads and shocks without undue deformation. It is a function of the strength and ductility of the steel but is not a quality susceptible to exact measurement. For comparing different steels, the relation of the yield point to the ultimate strength, the elongation, and the reduction of area, for any given hardness, may be used.

4. Impact toughness, as measured by the Charpy or Izod machines, is an indication of the capacity of the steel to withstand shock or impact loads without failure by fracture. It has been receiving more and more attention of late, for it is an excellent indication of the toughness, or more definitely, the lack of brittleness. It should not be used to the exclusion of the static toughness—both should be considered. In general, impact strength seems to relate to the grain size (the finer the grain size the higher the impact strength), and though no exact relation has yet been found, it seems to be a function of the reduction of area.

Control of Distortion

5. Decreased distortion can be had by using low quenching temperatures, rapid heating, and slow cooling at quenching. Low quenching temperatures can be obtained by use of some of the alloy steels which have low critical points, principally the nickel and molybdenum steels. Slow cooling at quenching is obtained by the use of an oil bath, or for some of the less frequently used air hardening steels, by cooling the air.

The grain size of the steel used has an important but seldom recognized effect on the amount of distortion. Controlled and fine grain sizes have a lesser tendency to distort. Lack of normalizing or annealing and normalizing at or quenching from too high temperatures are also causes of distortion.

The purchase of steel of the highest quality is an excellent way to reduce distortion or keep it uniform—sometimes a more important point than the amount of distortion present. Inclusions, segregations and seams, are the characteristics of "dirty" or poor steel and their presence makes successful heat-treating almost impossible.

6. The machinability of a steel, like its wearing qualities, is a function of the hardness and toughness of the steel. On gears, which are machined before heat treating, good machinability is obtained by normalization. The hardness at which machining after heat-treatment is practical and economical varies considerably with the type of steel, the treatment and the amount of hardness penetration. In general, the qualities which lower the allowable machining hardness are a fine grain size and a high degree of toughness. Some of the alloying elements also tend to make machining difficult.

7. The susceptibility of the different steels to heat-treatment and the ease with which they may be treated has been pretty well defined. The carbon steels and most of the alloy steels can be treated with equal ease. Different plants seem to have difficulty in treating efficient steels.

Selection of Steel

Having decided upon the desired qualities which the gear must possess and the characteristics necessary to fulfill these qualities, the engineer must select a steel and heat-treatment that possess, in the greatest number and highest degree, the necessary characteristics.

Gear steels may be divided into two general classes—the plain carbon and the alloy steels. Alloy steels are used to some extent in the industrial field but heat-treated plain carbon steels are far more common.

The use of untreated alloy steels for gears is seldom, if ever, justified and then only when heat-treating facilities are lacking. It is true that the strength and toughness of normalized alloy steels are somewhat greater than for an untreated, plain carbon steel of the same carbon content, but the higher values of those properties alone do not justify the additional cost, and in no case will an untreated or normalized alloy steel be comparable with a heat-treated, plain carbon steel.

Heat-treated alloy steels have some advantages over heat-treated plain carbon steels. Those advantages, while important, are not as numerous or as great as generally supposed. For instance, to emphasize a previous statement: An important fact—not generally known—is that the ultimate strength of heat treated alloy steels is nearly identical to that of heat-treated carbon steel of the same hardness.

The factors which determine whether to use heat-treated plain carbon steels or heat-treated alloy steels are thus: Does the service condition or design require the superior characteristics of the alloy steels, or if alloy steels are not required, will the advantages to be derived offset the additional cost? For most applications, plain carbon steels, heat-treated to obtain the best of their qualities for the service intended, are eminently satisfactory and quite economical.

Kinds of Heat-Treatment

The results of recent investigations and a study of existing data have convinced the author that the only advantages obtained from the use of heat-treated alloy steels over that of heat-treated plain carbon steels, are as follows:

1. Increased surface hardness and depth of hardness penetration for the same carbon content and quench.

2. The ability to obtain the same surface hardness with a less drastic quench and, in the case of some of the alloys, a lower quenching temperature—thus giving less distortion.

3. The increased toughness as indicated by the higher values of yield point, elongation and reduction of area.

4. The finer grain size obtainable with the resulting higher impact toughness and increased wear resistance.

5. In the cast of some of the alloys, better machining qualities or the possibility of machining at higher hardnesses.

Each of the two general classes may be further subdivided as follows:

1. Case hardening steels,

2. Full hardening steels,

3. Steels that are heat-treated and drawn to a hardness that will permit machining.

1. The first two—case hardening and full hardening steels—are interchangeable for some kinds of service, and the choice is often a matter of personal opinion. Case hardening steels with their extremely hard, fine grained (when properly treated) case, and comparatively soft and ductile core, are generally used when resistance to wear is desired. Case hardening alloy steels have a fairly tough core but not as tough as that of full hardening steels.

There is a considerable difference of opinion regarding the ability of the case hardened steels to withstand shock loads successfully. Because of the tendency of the extremely hard and brittle case to crack or spall under shock loads, the author's preference is for the full hardening steels for applications where this condition is pronounced.

In order to realize the greatest benefits from the core properties, case hardened steels should be double quenched. This is particularly true of the alloy steels because the benefits derived from their use seldom justifies the additional expense unless the core is refined and toughened by the second quench. The penalty that must be paid for the additional refinement is increased distortion, which may be excessive if the shape or design is not all that it might be.

2. Full hardening steels are used when great strength, high endurance limit, toughness, and resistance to shock, is required. The degree of these qualities is governed by the kind of steel and treatment used. Fairly high surface hardnesses are obtainable in this group, though not as high as those of the case hardening steels. For that reason the resistance to wear is not as great as might be obtained, but when wear resistance combined with great strength and toughness is required, this type of steel is superior to the others.

Full hardening steels distort to some extent when hardened, the amount being dependent upon the steel and quench used. For that reason the use of full hardening steels is not suitable for high speed gearing where noise is a factor, or for gearing where accuracy is of paramount importance, unless of course, grinding of the teeth is practicable.

The medium and high carbon percentages require an oil quench but a water quench may be necessary for the lower carbon contents in order to obtain the highest physical properties and hardness. The distortion, however, will be greater with the water quench.

Core Hardness Limits Design

3. When grinding the teeth is not practicable and a high degree of accuracy is required, hardened steels may be drawn or tempered to a hardness that will permit cutting the teeth. This treatment gives a highly refined structure, great toughness and, in spite of the low hardness, excellent wearing qualities. The lower strength is somewhat compensated for by the elimination of increment loads due to impacts which are caused by inaccuracies.

When steels, which have a low degree of hardness penetration from surface to core, are treated in this manner, the design cannot be based on the physical properties corresponding to the hardness at the surface. Since the physical properties are determined by the hardness, the drop in hardness from surface to core, due to the low degree of hardness penetration, will give lower physicals at the root of the tooth where the stress is greatest.

The quenching media may be either oil, water or brine depending on the steel used or hardness penetration desired. The amount of distortion, of course, is immaterial because the machining is done after heat-treating.

When it is deemed necessary to use a heat-treated alloy steel in order to obtain superior characteristics on properties over those of heat-treated plain carbon steels, the selection of the alloying element or elements to use is difficult. Some of the elements have similar effects, some have overlapping qualities and others introduce quite detrimental conditions. Compromise is necessary, but the choice, because of the overlapping qualities, is to some extent often a matter of personal opinion. For use in deciding on the particular kind of alloy steel some of the more important characteristics imparted by the different alloying elements are given briefly below. The comments apply only to heat-treated steels for the same quench. The effect of the addition of the alloying elements, in the conventional amounts, to steels of a given carbon content is compared with a plain carbon steel of the same carbon content.

Influence of Alloys

NICKEL: The addition of nickel tends to increase the hardness and strength with but little sacrifice in ductility. The hardness penetration is somewhat greater than that of the plain carbon steels. Its use as an alloying element lowers the critical points and therefore gives less distortion because of the lower quenching temperature. The nickel steels of the case hardening group carburize more slowly but the grain growth is less.

CHROMIUM: Chromium increases the hardness and strength over that obtained by the use of nickel, though the loss of ductility is greater. Chromium refines the grain and imparts a greater depth hardness. Chromium steels have a high degree of wear resistance and are easily machined in spite of the fine grain.

MANGANESE: When present in sufficient amounts to warrant the use of the term alloy, the addition of manganese is very effective. It gives greater strength than the use of nickel and a higher degree of toughness than chromium. Because of its susceptibility to cold work,

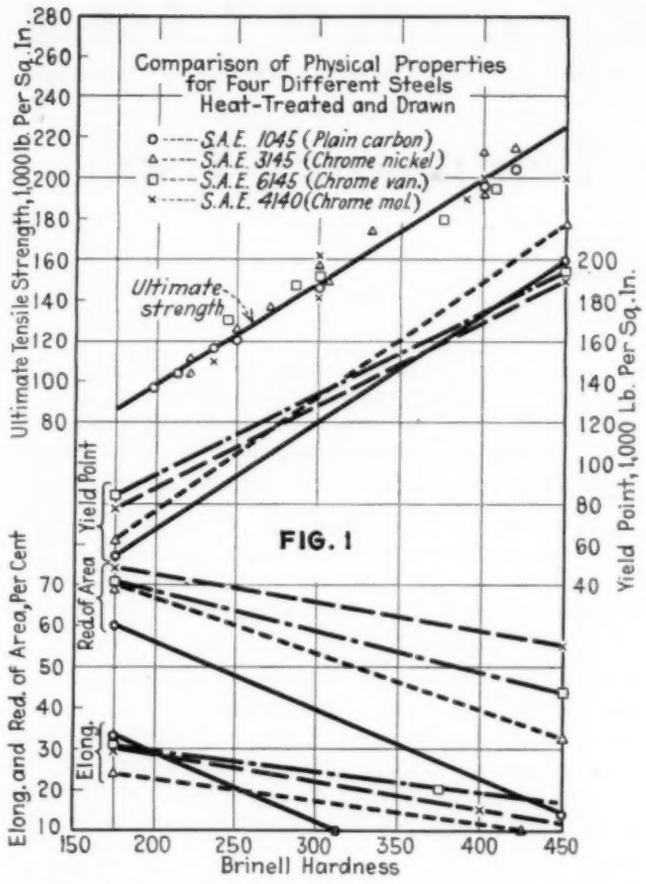


FIG. 1

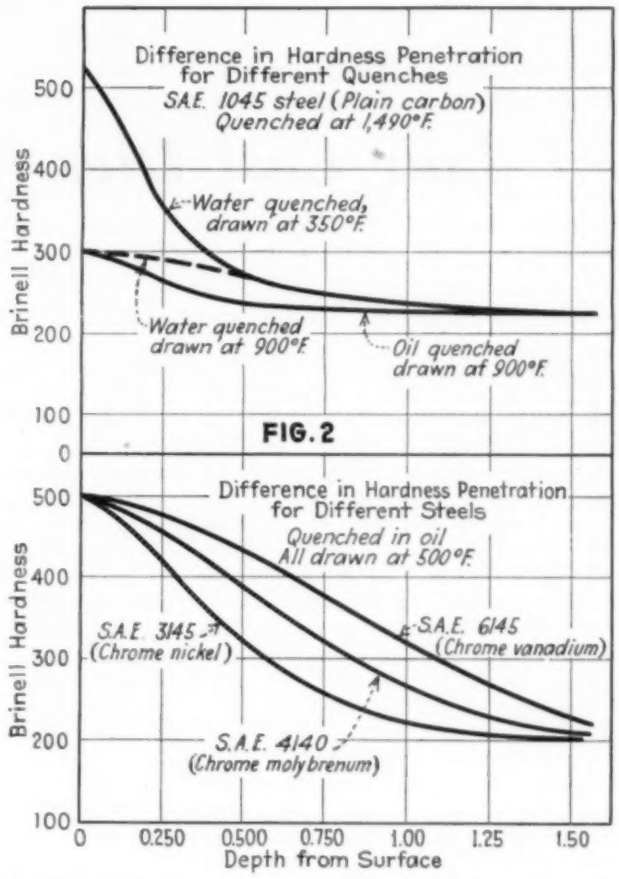


FIG. 2

it is likely to flow under severe unit pressures. Up to the present, it has never been used to any great extent for heat-treated gears, but is now receiving an increasing amount of attention.

VANADIUM: Vanadium has a similar effect to that of manganese, increasing the hardness, strength and toughness. The loss of ductility is somewhat more than that caused by manganese, but the hardness penetration is greater than for any of the other alloying elements. Because of the extremely fine grained structure, the impact strength is high. It has a disadvantage in that its presence tends to make machining difficult.

MOLYBDENUM: Molybdenum has the property of increasing the strength without affecting the ductility. For the same hardness, steels containing molybdenum are more ductile than any other alloy steels and, having nearly the same strength are tougher; in spite of the increased toughness, the presence of molybdenum does not make machining more difficult. In fact, such steels can be machined at a higher hardness than any of the other alloys. The impact strength is nearly as great as that of the vanadium steels.

CHROME-NICKEL STEELS: The combination of the two alloying elements combines the beneficial qualities of both. The high degree of ductility imparted by the nickel is complemented by the high strength, finer grain size, deep hardening and wear resistant properties imparted by the addition of the chromium. The increased toughness makes them somewhat more difficult to machine than the plain carbon steels and they are somewhat difficult to heat-treat. The distortion increases with the amount of chrome and nickel.

CHROME-VANADIUM STEELS: Chrome-vanadium steels have practically the same tensile properties as the chrome-nickel steels, but the hardening power, impact strength and wear resistance increased by the finer grain size. They are difficult to machine and distort more than the other alloy steels.

CHROME-MOLYBDENUM STEELS: This group has the same qualities as the straight molybdenum steels, but the hardening depth and wear resistance is increased by the adidtion of the chromium. This steel is very easily heat-treated and machined.

NICKEL-MOLYBDENUM STEELS: Nickel-molybdenum steels have qualities similar to chrome-molybdenum steel. The toughness is said to be greater although the steel is somewhat more difficult to machine.

Fig. 1 shows the comparison of physical properties of four different steels. The values given are an average of all the figures that could be found and were obtained from tests, text books, various catalogs and handbooks. In the main, all the figures from the different sources agree quite closely, but when there are discrepancies, they are so extreme that the conclusion of error is obvious.

All the values found for the ultimate strength are shown in order to illustrate the fact that it is identical for a given hardness. It is surprising to note how closely the points agree. In order to avoid confusion, only the averages for values found for the other properties are given. Except in the case of the elongation for the SAE 1045 and SAE 4140, all the values given by the different authorities agree even more closely than they do for the ultimate strength. For those two steels, quite marked discrepancies were found for the elongation, so the values believed to be the more accurate were used.

Much can be learned by comparing different steels in a similar manner. For instance: A chart showing the various properties, for different steels of the same carbon content, plotted against drawing temperatures; or one comparing the properties for the different carbon contents plotted against the hardness, would be quite enlightening.

Fig. 2 shows the difference in hardness penetration for one steel and two different quenches and also for three different steels given the same quench and draw. By comparing the two charts the difference in the properties for the different hardnesses can easily be determined.

Low Cost Dies for Temporary Use

HARRY SWANSON

INEXPENSIVE punches and dies, for use when only a comparatively few duplicate pieces are needed, has always been a problem for the shop man. The condition was aggravated by the depression and great interest has been shown in methods of producing such punches and die in an inexpensive manner. The methods given herewith are not entirely new but they do not seem to be as well known as might be expected. In brief the method is as follows:

Take a piece of cold rolled flat plate large enough to leave about 2 in. all around the piece to be punched. The thickness of the plate depends on the gage of metal to be punched. It is good practice to use $\frac{1}{16}$-in. stock for all thickness of sheet up to $\frac{3}{32}$ in. and $\frac{1}{4}$-in. stock for $\frac{1}{8}$-in. sheet. It is a good plan to add $\frac{1}{8}$ in. of plate thickness for each $\frac{3}{32}$ in. of sheet punched.

File or grind the sharp edges and clean one side of the plate. This can be ground or cleaned with abrasive cloth. Give it a coat of blue vitriol and lay out the blank in the usual way.

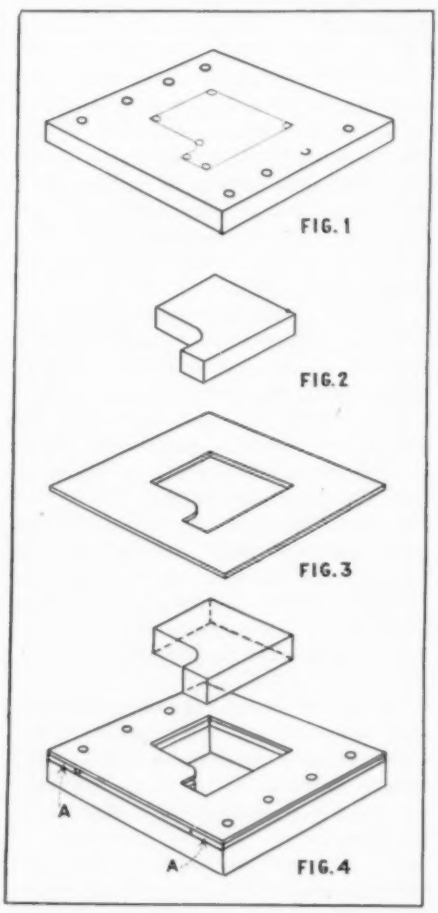
Start Saw in Drill Hole

Drill a hole large enough for No. 5 coping saw blade at one corner, or where it seems best to start the saw. There should also be similar holes at each corner where the saw must be turned. Saw out the die just inside the scribed line, leaving only a little material for finishing with a file. File the outline as accurately as possible, allowing about 5 deg. clearance from the cutting edge toward the back.

Check the measurements and drill a few $\frac{1}{8}$ in. holes along two sides of the die as in Fig. 1. This shows the die plate with the outline of the die and also the holes drilled at the corners for permitting the saw blade to be put through and turned at the corners. The die is then heated in a cyanide bath for 30 min. and hardened by quenching in water. The die should be dipped vertically to minimize distortion.

After the die is cooled it must be checked to detect any warping that may have taken place in the heating and quenching. Minor changes can be corrected by careful peening with a hammer and a slightly rounded punch or a small hand grinder may be used to bring the die back to its correct size.

The punch is also made of cold rolled steel, at least $\frac{1}{8}$ in. thicker than the die. Clean one surface and apply blue vitriol as before. Clamp the piece for the punch securely over the opening in the die. Make the shape on the blued surface, through the die, using a fine scratch point. Saw out the punch with the coping saw, as with the die, and finish with a file until it will just enter the die. Harden the punch in cyanide.



How low cost dies are made: Fig. 1 is layout of die; Fig. 2 the punch; Fig. 3 the stripper; Fig. 4 punch and die ready to use

Next take a piece of strip steel $\frac{1}{8}$ in. thick and large enough to cover the die and clamp securely to the die and work out the opening with saw and file, until the punch will just slip through the opening. Before removing the plate drill at least four holes to match those in the die. Fig. 3 shows this stripper plate which also acts as a guide for the punch.

Before fastening the stripper plate to the die put a spacing strip on each side of the opening, between the two parts as at *A*, Fig. 4. These strips should be $\frac{3}{32}$ in. thicker than the material to be punched. These strips act as guides and the $\frac{3}{32}$-in. extra thickness allows the strips to slide through easily. The die, spacing strips and strippers are riveted together as shown. The punch should now pass freely through both stripper and die. Then the tools are ready for work. Fig. 4 shows the punch above the die opening.

Any Punch Press Will Do

Any punch press which has power enough to punch the stock can be used for the work. Die shoes with flat faces and large enough to support the die are put in place in the press. Adjust stroke of press to suit the die and the material. Push the strip to be punched into the die and put the punch in the opening in the stripper plate where it will rest on the strip. Trip the press, which will force the punch through the metal and both will drop on the lower shoe. The punch is then recovered just as in the case of push broaches. The process is repeated for each punching.

Punches and dies of this kind are only economical where quantities are less than from 5,000 to 10,000 pieces, depending on size of blank and difficult shape of blank, as the time for handling is large as compared with regular punch and die sets. Temporary dies of this kind will last for several hundred thin punchings if care is taken. The same type of punch has also been used in punching sheets up to $\frac{1}{8}$ in. in thickness where only a few pieces are needed as in experimental aircraft fittings.

EDITORIALS

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EDITORS

Up to Industry

THE NATIONAL Recovery Administration is practically a year old. Under the terms of the act it has a year to run unless terminated by Congress or the President before that time has elapsed. New legislation will be necessary to extend it. At the present moment it is being subjected to a critical examination to see why it has not come up to expectations.

Two of the most serious objections lie in the failure of the machinery to enforce compliance and in the attempt to make a permissive act all inclusive. A good deal of the blame for both can be placed at the door of industry. Groups with no experience in cooperation and self-regulation wrote codes with no idea how some of the provisions were to be policed. They wanted to get out from under the anti-trust laws, and they wanted to scotch the chiseler.

As might have been foreseen, the result was a topheavy structure that has begun to totter, as is evidenced by the suggestion that codes involving intrastate and service industries be abandoned. Despite the immediate flood of protesting telegrams that followed this suggestion it is probable that it will have to be adopted if the more important industrial codes are to be administered.

But does industry want codes, and if so does it want them enough to take an active part in policing them? Is it willing to pay the cost of administering them? Is it ready to make strong recommendations for any changes that should be made, and to back up the recommendations with carefully thought out reasons? A case in point is the reply of the Durable Goods Industries Committee to the twelve points raised by General Johnson at the March code authority conference. That reply represents the kind of thing that must be done, but it is unfortunately prominent because of its rarity.

The makers of capital goods of all kinds, the durable goods manufacturers, and all the various smaller groups allied with them have a job to do. Some of them, like the machine tool builders, have a strong trade association able and willing to produce needed facts, figures and opinions on short notice. Others are just getting started and have only begun to learn the advantages of mutual confidence and respect, and the achievements possible through coordinated action.

As a whole the machinery group at last has a rallying point, an organization through which its collective voice may be heard. The Machinery and Allied Products Institute has had a difficult time getting under way but it is now a going concern and merits every possible effort to widen its usefulness and stimulate its activity. Such a mechanism has long been needed, the coming of NRA simply brought things to a head. And long after NRA has passed into history it will have a reason for existence and a big task to perform. Other fields need corresponding institutes or associations.

It is up to industry to decide whether it shall stand united or disintegrate, which codes are necessary and which are not, whether this country shall continue powerful industrially or revert to an agricultural economy and handicrafts. Strong, constructive trade groups must be continued, weak ones must be strengthened, new ones must be organized where there are none and where the need exists. The alternative is state socialism or some other form of political economy foreign to our experience and to our ideals.

Erratic Accounting

ACCOUNTING, as frequently practiced, deserves to be classed among the wonders of the world. Cost sheets, in some cases at least, mean very little unless we know how they are made, and they often play havoc with the production man's ideas of shop costs.

One case that has come to our notice is that of a special machine built by a previous régime, and that never worked. Yet this machine is charged against present production costs as part of the machine overhead. It should, of course, have been charged to profit and loss, and the account credited with whatever was received from the junk man.

Another case of accounting that takes a lot of explaining involves a large special machine that has become a back number. This machine originally cost $32,000 and the makers offer to rebuild it to include all new gadgets and bring it up to date for $8,000. Or they will supply a new machine for $18,000.

Assuming that the expenditure of $8,000 will make the old machine as efficient as the new one, this represents a saving of $10,000 for machine equipment. But instead of helping reduce production overhead costs it adds to them, as cost accounting is done in this plant. For the accountant adds the $8,000 to the original cost of $32,000 and charges production with $4,000 machine overhead, 10 per cent of the total cost of the machine plus all maintenance charges. If they spend $18,000 and buy the new machine the production department is only charged with $1,800 overhead and probably no maintenance charge for the

first year. This particular accountant only charges production overhead on machines in the production line, the old machine being charged to profits and loss.

The third case concerns such equipment as portable tools, electric drills and the like. Some shops charge these as machine equipment while others list them as supplies the same as drills, reamers and the like. This simplifies bookkeeping and seems to work.

When figures derived from accounts kept in this way are used to estimate costs, it is easy to see how far apart figures and actual costs may be. Can there be any question as to the need for more logical accounting methods and for both standardization and simplification along this line?

Versatile Operators

SPECIALIZATION seems on the way toward modification. Not so many years ago efficiency engineers were strong on making extreme specialists of every man in the shop. A boy was taught to run a certain kind of turret lathe or gear cutter and was afraid to tackle any other machine.

Modern line production methods are changing this considerably. Instead of grouping all the milling machines in one department, we find a miller with a broaching machine on one side and a heat-treating furnace on the other. Just beyond may be a lathe and a riveter. In some cases, especially in the production below the peak, the same man may handle them all, one after the other. Automatic or remote controls make this possible.

This type of shop layout is becoming popular. It cuts down inventory of parts in process and reduces handling to a minimum. It makes a more flexible or versatile type of operator necessary. And this increases his chances of getting a job in other shops. It also imposes a harder task on the training and personnel departments, but makes the work more interesting. Men with wider experience, and especially of wider vision, are needed to handle the newer problems of personnel.

.CHIPS.

Washington—President signs tax bill designed to stop leaks and transfer some of the load from earned incomes to unearned ones . . . Failure of Senate to approve Thorp as Director of the Bureau of Foreign and Domestic Commerce brings acid criticism from Assistant Secretary of Commerce John Dickinson who takes over the job pending the finding of a successor . . . NRA gets ready to drop some of the unenforceable codes in the service and intrastate industries . . . Will publish Darrow committee report and an answer to it . . . Air mail is back in private companies' hands . . . Secretary Wallace threatens world wheat war if control conference fails . . . President asks Congress for $1,322,000,000 to complete his recovery program . . . Loans to industry and building construction to be major offensives this summer . . . Senator Glass resigns from Banking and Currency Committee charging conference is packed to force administration of Exchange Control Bill by Federal Trade Commission.

Foreign—Germany starts building a powerful air force to be completed in 1936, buys engines and planes here and in England . . . Threat of Johnson Act stirs up War Debtors as June 15 approaches . . . Nazi Minister of Agriculture tells Junkers they are all through and that their estates will be divided among peasants . . . England and France discuss armament increases as hope of disarmament conference success fades . . . Efficiency of anti-Nazi boycott proved by Goebbels' threats of harm to Reich Jews . . . Italy, Austria and Hungary sign trade agreements to combat Nazi aggression . . . Fascist coup wins control of Latvia . . . German farm labor prohibited from migrating to cities . . . Soviets planning to buy gold mining machinery here to increase output.

Finance—Big banks move to complete divorcing of security affiliates as hope of postponement of that provision of the banking act grows dim . . . Congress passes measure authorizing loans up to $530,000,000 to industry from Federal Reserve Banks and R.F.C. . . . Roosevelt throws his support to House version of Securities Exchange Control Bill which would set margins at 45 per cent and designate Federal Trade Commission as control agency.

Industry—Fisher Body strike forces closing of Buick plant on eve of new model announcement . . . B. & O. orders light weight train powered by steam locomotive . . . B. & M. will buy two diesel-powered streamlined units, light passenger cars, heavy locomotives with PWA loan . . . Reorganization of Willys-Overland imminent as receivers complete 5,000 of projected 7,500 cars . . . Stocks of copper were reduced materially in April . . . Industrial buying, particularly of equipment, slows down as business waits to see whether further obstructive legislation will be enacted before Congress adjourns.

Indicators—Electric power production continues rise although spread above corresponding 1933 week is narrowed . . . Steel production also gains but is believed to have about reached its peak . . . Business Week's Index rises from 66.7 to 67.1.

MAPI Elects Directors and Code Authority

More than 300 members of the machinery and allied products industries met in Cleveland on May 14 and 15 to elect directors and discuss plans for the difficult period ahead. George H. Houston, president of the Baldwin Locomotive Works, and chairman of the Durable Goods Industries Committee appointed to advise NRA at the March code authority conference, related the experiences of that committee, singled out the Securities Act of 1933 as the principal bar to industrial recovery, and stated his belief in the principles of the capitalistic system as opposed to the principles of collectivism accepted by many of the group now influencing legislation and administrative policy in Washington. He found the two entirely incompatible.

Speaking from the same platform Col. Leonard P. Ayres, economist of the Cleveland Trust Co., placed the Securities Act in third place in his list of the major fears that are retarding recovery, rating fear of further extension of government influence and uncertainty of the future value of our money ahead of it. He concluded by mentioning these other bars to recovery in the durable goods industries: Shrinkage of foreign trade; high cost of building construction; difficulty of obtaining building loans; difficulty of making industrial profits under NRA codes.

Sitting in the morning of May 14 as the Machinery and Allied Products Institute, the meeting elected as members of the executive committee to serve until next November: P. C. Brooks, executive vice-president, Fairbanks, Morse & Co., Chicago; W. C. Dickerman, president, American Locomotive Co., New York; Robert E. Friend, president, Nordberg Mfg. Co., Milwaukee; Leo W. Grothaus, Allis-Chalmers Mfg. Co., Milwaukee; George H. Houston, president, Baldwin Locomotive Works, Philadelphia; D. C. Keefe, executive vice-president, Ingersoll-Rand Co., New York; Robert M. Gaylord, president, Ingersoll Milling Machine Co., Rockford, Ill.; A. M. Mattison, president, Mattison Machine Works, Rockford, Ill.; C. E. Searle, executive vice-president, Worthington Pump & Machinery Co., Harrison, N. J.; Harold C. Smith, president, Illinois Tool Works, Chicago; George P. Torrence, president, Link-Belt Co., Chicago; C. S. Wagner, vice-president, Koehring Co., Milwaukee; P. M. Morgan, president, Morgan Construction Co., Worcester, Mass.; M. F. Dunne, president, Pyott Foundry & Machine Co., Chicago; Guy A. Wainwright, president, Diamond Chain & Mfg. Co., Indianapolis.

In the afternoon the meeting reconvened as the machinery and allied products industry and elected as members of the basic code authority for the industry these eight members of the executive committee of the Institute: Brooks, Dickerman, Friend, Grothaus, Houston, Mattison, Torrence and Wainwright, and in addition: W. S. Shipley, York Ice Machinery Co., York, Pa.; Paul C. DeWolf, Brown & Sharpe Mfg. Co., Providence, R. I.; N. W. Pickering, Farrel-Birmingham Co., Ansonia, Conn.; Dennis F. O'Brien, A. P. Smith Mfg. Co., East Orange, N. J.

As chairman of the program comittee, R. M. Gaylord, president, Ingersoll Milling Machine Co., outlined some of the work ahead of the Institute. In this category he included cooperation with code authorities; presenting the viewpoint of the industry on legislation affecting tariffs, shorter hours, discriminatory excise taxes, government manufacturing and trading; the Army proposal to do basic research on roller and lift gates; the Navy project under the Vinson Bill for a standard cost system and 10 per cent profit on Navy contracts; the Stock Exchange Bill as it sets up control over industry. He said further that the Institute could be helpful in advising Washington on the most effective use of relief funds, in the promotion of foreign trade, in advancing the fundamental principles of capitalism, in defining the relation of the durable goods industries to the machinery industry, and in the formation of needed trade associations.

John W. O'Leary presided over both sessions, in the morning as president of the Institute, and in the afternoon as chairman of the basic code authority. On Tuesday 28 different groups in the Institute met separately to consider their respective code problems.

PWA Approves N. Y. Central Loan

A loan contract totalling $2,500,000 to the New York Central Railway Co. was recently signed by Harold L. Ickes, Public Works Administrator. Of this the company will use $2,500,000 to purchase 37,000 tons of rails and fastenings, and $400,000 to pay its track forces laying them. It is estimated that laying the rail will create 1,147,000 man-hours of labor. The company will use its own funds on all wages in excess of $400,000. Including this contract, the Public Works Administration placed under contract $177,395,000 of the $199,607,800 allotted for work creating loans to railroad companies.

Other work-creating loan contracts recently announced are those to the Boston & Maine, the Grand Truck Western, the Delaware, Lackawanna & Western, and the Chicago Great Western railroads.

The Boston & Maine loan of $1,550,000 is the third to this company and will be used for general program of roadway improvements. The creation of 1,330,000 man-hours of additional employment for maintenance of way men and an equal amount of indirect and industrial employment is estimated. The Grand Trunk will use its loan of $250,000 to purchase 4,250 tons of rail and the fastenings required for laying it.

The Delaware, Lackawanna & Western will use its loan of $1,043,000 to convert 20 road engines into switching engines and 986 wooden box cars into steel sheathed cars. Fifty of these will be automobile cars equipped with the Evans Auto Loader, a device which permits either one or two extra cars, depending on size, to be shipped in each freight car. The purchase of 500 steel box cars will result from the loan of $1,200,000 to the Chicago Great Western. It is estimated that the manufacture of these will create 200,000 man-hours of employment in the builder's shops.

E. G. Todt Made A.M.T.I. President

At the annual meeting of the American Machinery and Tools Institute, held recently in Chicago, E. G. Todt, of E. G. Todt Co., was elected president, and Rudolph Krasberg, of B. Krasberg & Sons Mfg. Co., was made vice-president. Craig B. Hazelwood, First National Bank, and Geo. R. Tuthill were named treasurer and secretary, respectively. The following were elected to the board of directors: E. R. Prout, Teletype Corporation; J. S. Kozacka, Lewis Institute; F. B. Coyle, International Nickel Co.; A. C. Wais, Niles Tool Works, and J. Gordon Barr, Morse Twist Drill & Machine Co.

Machine Tool Orders Again Decline

Continuing the downward trend in evidence since December, gross orders of machine tools for April receded to an index of 46.5 based on the second report of the industry's supervisory agency. With average shipments for 1926 taken as a base, the index numbers since January and the breakdown between domestic and foreign orders are given in Table I. It will be seen that the slight increase in foreign orders during April was more than offset by the decline in domestic sales.

Table II which divides the figures into sales by concerns, having a volume of sales in 1926 above $200,000 and those having less than $200,000 for the same period, shows that foreign orders are enjoyed chiefly by the larger companies. The smaller companies showed an uptrend until April when they, too, slipped.

In Table III the distribution of orders by companies is shown for the industry. The increasing number of concerns, progressively bettering 50 per cent of their 1926 sales, during the first quarter was encouraging. However, the number of these concerns also fell off during April.

A chart in preparation by the statistical department of the industry's supervisory agency will show the comparison between the new index based on the year 1926 and the old index of the National Machine Tool Builders' Association based on the years 1922, 1923 and 1924.

TABLE I—INDEX OF ORDERS BASED ON SHIPMENTS FOR 1926

Month	No. of Reports	Index			Per Cent of Foreign to Total Orders
		Total	Domestic Orders	Foreign Orders	
January	163	53.7	43.9	9.8	18
February	163	50.9	40.5	10.4	21
March	163	48.1	40.1	8.0	17
April	163	46.5	36.2	10.3	22

TABLE II

Group A—Companies reporting year's sales in 1926 of $200,000 or more

Month	No. of Reports	Index			Per Cent of Foreign to Total Orders
		Total	Domestic Orders	Foreign Orders	
January	82	54.0	43.5	10.5	19
February	82	50.7	39.5	11.2	22
March	82	47.2	38.8	8.4	18
April	89	46.2	35.3	10.9	24
Group B—Companies reporting year's sales in 1926 of less than $200,000					
January	81	49.8	48.3	1.5	3
February	81	53.0	50.6	2.4	5
March	81	57.3	54.7	2.6	5
April	74	50.3	48.2	2.1	4

TABLE III — DISTRIBUTION OF ORDERS BY COMPANIES

Index Group Individual Company Orders in Per Cent of 1926 Shipments	Number of reports in each Index Group			
	January	February	March	April
100% of 1926 or more	21	20	21	21
50%–99%	29	32	36	33
Less than 50%	113	111	106	109
Total reports	163	163	163	163

Machine Hour Limitation to Be Examined

The right given by NRA to close all plants in an industry for a definite period or for specific curtailment of production hours, as has been done in certain textile groups, will hereafter not be granted without hearings to determine whether public interest and the workers are justly treated in the plan.

Codes containing provisions allowing for emergencies contain also provisions allowing the restriction of machine hours and increases in plant capacity which NRA thinks carries with it a responsibility by the industry to keep efficient and give the consumer fair prices without undue profit. The drive is not at the profit motive, but at the possible abuse of the virtual monoply right conferred by codes which restrict machine hours of efficient plants, making it impossible for other plants to modernize.

April Foundry Equipment Orders Show Decrease

Gross orders for foundry equipment in April had an index of 67.9, based on the monthly average for the years 1922-23-24, according to a report issued by the Foundry Equipment Manufacturers Association. This compares with 75.4 in March and 19.4 in April 1933. Shipments were at 55.5 as against 62.6 in the preceding month and 55.1 a year ago. Unfilled orders increased, having an index of 63.0 contracted with 51.5 for March and 14.7 for April 1933. The three months' average of gross orders also improved, reaching 67.7 compared to 59.5 last month and 15.1 last year.

Chase Brass Holds Show for Workers

Preliminary to its introduction of a new line of electric lighting fixtures, the Chase Brass & Copper Co. held a private showing for its factory employees. Management and labor together viewed the results of the company's entrance into a new field less than a year ago.

About 75 workmen sat down to dinner with F. S. Chase, president of the company, and other officials, including E. T. Stannard, president of Kennecott Copper. H. H. Holdsworth, chairman of the Workers' Council, spoke for the men.

Warner & Swasey Completes Navy Telescope

To be used for photographing heavenly bodies never seen, a telescope has been completed by the Warner & Swasey Co. for the U. S. Naval Observatory at Washington. This instrument is to be erected immediately. No one will ever look through this telescope, since the observer trains it upon the portion of the sky he desires to study by means of a finder. He then looks through a guiding telescope somewhat more powerful and proceeds to take photographs by use of the main instrument.

Metal-Working Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
May 24	Commerce Building	L. S. Hovner	Shoe Shank Manufacturer (cost hearing)
May 24	Raleigh Hotel	R. W. Murray	Warm Air Manufacturers (amendment)
May 31	Raleigh Hotel	C. F. Craig	Gray Iron Founders' Society (amendment)

Time Extended for MAPI Code Authority Selection

As originally drawn the code of fair competition for the Machinery and Allied Products Institute required that supplementary industries choose their code authorities within 60 days of March 28, the approval date of the basic code. Because of the delays which have arisen in connection with the approval of supplementary codes, the time limit has been extended an additional 60 days.

Senate Passes Bill for Industrial Loans

On May 14 the Senate adopted the Glass-Barkley Bill which provides that approximately $530,000,000 be made available to solvent business enterprises during the present period of credit stress. Of this sum $280,000,000 would be supplied by the Federal Reserve Banks and about $250,000,000 by the Reconstruction Finance Corporation.

The bill was transmitted to the House where a similar measure has been reported from the Banking and Currency Committee.

Action Abroad Awaited on Arms Control

Following President Roosevelt's message to the Senate on arms control, in which he requested the appointment of a committee to investigate the private manufacture of arms and munitions, administration officials are waiting for other governments to follow the lead taken by the United States. A statement by Secretary Hull expressed the hope that every nation which sells arms will cooperate to make the proposed embargo against Paraguay and Bolivia effective.

Norton Machine Show Moved to England

Norton Company's exhibit of its machine tool products, organized by H. W. Dunbar, general manager, and displayed at Worcester, Mass., last December, has moved across the Atlantic. The exhibit, so successful in this country, will be shown in Coventry, England, at the plant of Alfred Herbert Ltd., Norton's representative in England.

Administration Members Named for Code Authorities

Lawrence E. Connelly was appointed by National Recovery Administrator Hugh S. Johnson, as administration member for the foundry equipment code authority. Mr. Connelly was formerly vice-president of the D. Connelly Boiler Co. Other administration appointments to code authorities are as follows:

Collapsible tube industry—A. A. Ainsworth, trade association executive and former general manager of the David Williams Companies.

Tackle block manufacturing industry and snap fastener manufacturing industry—R. P. Barry, former railroad executive.

Canning and packing machinery and equipment industry—Alfred E. Waller, former chief engineer of the Ward Leonard Electric Co. and managing director of N.E.M.A.

Porcelain enameling manufacturing industry—Sam T. Johnston, past president of the American Foundryman's Association and the Foundry Equipment Manufacturers Association, and now vice-president of the Standard Sand and Machine Co.

Small arms and ammunition manufacturing industry, and umbrella frame and umbrella hardware manufacturing industry—H. B. Savage, former president of the Combustion Engineering Corporation and first president of the Refractories Manufacturers Association.

Machine knife and allied steel products industry—Charles Alan Brantingham of the Thompson and Lichtner Co.

Clay machinery industry—Professor G. A. Bole, Dean of Ceramics, Ohio State University.

Lightning rod manufacturing industry—Howard Berzolzheimer, Professor of Finance, Northwestern University.

Industrial furnace manufacturing industry—C. F. Cruciger, vice-president of the Spang-Chalfant Co.

Gas appliances and apparatus industry—E. A. Srill, president of the General Box Co.

Medium and low priced jewelry manufacturing, and precious jewelry producing industries—Thomas Bateman, formerly secretary and treasurer of the International Playing Card and Label Co.

Shoe machinery industry—Merton L. Emerson, consulting engineer associated with Scovell, Wellington & Co.

Locomotive industry—W. H. Sawyer, president of Stevens & Wood, Inc., formerly president of the American Railway Association.

• INDUSTRIAL REVIEW •

• All over the industrial section of the country machinery business is dropping. Labor troubles and threats of further strikes, uncertainty over what Congress and the Administration may do to restrict business, and a decided tendency on the part of industry heads to buy farms and sit tight instead of making plans for expansion of business and replacement of equipment are responsible. Few men in the industry expect much improvement before September.

• In the East—Boston, Philadelphia and New York—orders for May will not reach the April level. Business as a whole is rather quiet. Pittsburgh's April rush, mild as it was, has subsided. No serious labor trouble exists but the threat of a steel strike hangs over the district. Cleveland has settled its gasoline station strike but is worried over the possibility of a steel strike. A shortage of skilled men persists still in some metal-working plants.

• Cincinnati reports few orders and a falling off in inquiries. Plants that have been employing reasonable forces are beginning to wonder how they can maintain them unless orders pick up. Indianapolis business is holding up fairly well and distributors there hope to keep active during the summer. Detroit activity has lessened appreciably as plans for new motor car models are held in abeyance until the end of this session of Congress. There is very little buying of machinery.

• St. Louis reports settlement of its strike in the machinery field, but also a tendency to slacken off all along the line. Business is better than a year ago but leaves much to be desired. Chicago and Milwaukee find orders almost nonexistent and inquiries scarce. Most of the serious strikes have been settled.

Counterbore Concern Marks Twentieth Anniversary

This month the Eclipse Counterbore Company is celebrating the 20th anniversary of its founding. Since its organization in 1914, this concern has expanded from an infant organization, renting a few feet of space, to a sizable plant covering more than 25,000 sq.ft. The company has introduced a number of time-saving metal-cutting tools which have been instrumental in speeding up production, especially in the automotive industry.

Implement Exports Rise 36 Per Cent

With a total value of $1,659,575, exports of agricultural machinery from the United States showed a gain in March of 36 per cent above the corresponding month of last year, and 26 per cent above February of this year. More than one-half of the March total was made up of tractors and parts, of which shipments reached $885,273, representing a gain of 56 per cent over March, 1933. Tracklaying tractors were the most important, shipments amounting to 194 units valued at $358,785 as compared with 100 units at $143,275 last year. Wheel tractors also showed a satisfactory gain with 389 units shipped abroad during March having a value of $253,100 compared to 216 units valued at $176,747 during March, 1933.

Approved Codes in the Metal-Working Industry

(Continued from AM—Vol. 78, page 252f)

Code Sponsor	Maximum Hours	Minimum Wages	Deputy Administrator	Approval Date
Small Arms and Ammunition Industry	40	40c. males; 32½c. females; office workers $14-15.	King	Mar. 22
Preformed Plastics Industry	40	40c.; office workers $14-15.	Hickling	Mar. 23
Industrial Furnace Manufacturers	40	40c. North; 35c. South; time and a half for overtime.	Brady	Mar. 23
Manufacturers and Repairers of Cylinder Molds and Dandy Rolls	40	40c.; office workers $15.	Brady	Mar. 23
Print Cutting Jobbers Association	35	75c.; office workers $20.	Brady	Mar. 26
Metal Treating Institute	40	42c.; office workers $16.	Brady	Mar. 26
Air Valve Association	40	40c. males; 35c. females; office workers $15.	Murray	Apr. 1
Used Textile Machinery Distributing Trade	40	40c. North; 35c. South.	Brady	Apr. 4
National Association of Bottling Machinery Manufacturers	40	40c.; time and half for overtime; office workers $15.	Muir	Apr. 4
Snap Fasteners Manufacturers	40	40c.; division of FMPF.	King	Apr. 6
Umbrella Frame and Umbrella Hardware Manufacturers	40	40c.; office workers $16.	King	Apr. 6
Steel Plate Fabricators	40	40c. North; 35c. Virginia and Texas; 30c. South.	Murray	Apr. 6
Shoe Machinery Institute	40	40c.; office workers $15.	Brady	Apr. 6
Manganese Track Society	40	40c. North, 32c. for five Southern States; office workers $15.	King	Apr. 6
National Spray Painting and Finishing Association	40	40c. male; 35c. female.	Muir	Apr. 19
U. S. Copper Association	40	30 to 41c. dependent on territorial and type of work; office workers $15.	King	Apr. 20
Sewing Machine Trade Associations	40	40c.; office workers $15; store workers $10-14 with $1 less in the South.	King	Apr. 20
Railway Industrial Spring Association	40	40c. with other MAPI provisions.	King	Apr. 22
Locomotive Institute	40	40c.; division of MAPI.	King	Apr. 29
National Screw Machine Products Association	40	40c.; division of FMPF.	King	Apr. 29
U. S. Cap Screw Service Bureau	40	40c.; division of FMPF.	King	May 2
Can Labeling & Can Casing Manufacturers	40	40c.; office workers, $14-15; division of packaging machinery industry.	Brady	May 4
Counter Freezer Manufacturers	40	40c. time and a half for overtime; office workers $14-15.	Murphy	May 7
Associated Builders of Small Locomotives	40	40c.; division of MAPI.	King	May 7
U. S. Machine Screw Service Bureau	40	40c.; division of FMPF.	King	May 9
Wire Machinery Builders Association	40	40c.; division of MAPI.	King	May 9
American Drop Forging Institute	40	40c. North; 32c. in nine Southern States; office workers $15.	King	May 9
Association of Manufacturers of Woodworking Machinery	40	40c.; division of MAPI.	Muir	May 14
Beater, Jordon and Allied Equipment Manufacturers	40	36 to 40c. North, depending on population; 32c. South.	Muir	May 15

Commerce Department Plans Electrical Survey

Markets being lost to electrical equipment manufacturers will be surveyed by the Bureau of Domestic and Foreign Commerce of the Department of Commerce. The study, to be based upon findings of the real property survey for which CWA funds were furnished, is expected to take at least two months.

Andrew W. Cruse, chief of the electrical equipment division, is of the opinion that investigation will reveal a number of undeveloped markets for electrical appliances throughout the country. The purpose of the survey is not to develop the relation of power rates to the amount of electrical equipment in homes, as it is now thought in the bureau that cities showing the lowest percentages of appliances will be those with lower rates.

German Machine Industry Shows Improvement

BERLIN—During the first quarter of 1934 Germany gained nearly 50 per cent over the preceding year in the production of machinery, according to Rolland Welch, assistant trade commissioner. Most of this gain resulted from increased local consumption since exports continued at a low ebb. The improved condition puts the German machine industry on a better basis than it has been for the last four years.

However, for more prosperous conditions, Germany must look to an export market. In 1928-9 between 40 and 60 per cent of production went abroad. Now foreign sales amount to only 10 per cent. Despite this decline in shipments abroad, the index figure for January 1934 was 54.8, with the 1928 monthly average taken as 100.

The greatest amount of improvement during the first quarter of 1933 was in machine tools, conveying, crushing and dressing machines, textile machines, agricultural machines and to a lesser extent, power machines, pumps and compressors, construction machinery and weaving machinery. Manufacturers of refrigerating machines, food-stuff machines and paper machines are still suffering from lack of business. Statistics covering foreign trade in machinery during January and February, 1934, supplied by the Verein Deutscher Maschinenbau-Anstalten are as given below.

Cheaper Dollar Helps U. S. Machine Tools

American machine tools have improved their position in the British market as a result of the revaluation of the dollar, according to the Department of Commerce. One resident American sales representative has reported that the 1933 sales of a particular specialty are 22 per cent ahead of 1932, and that the first two months of 1934 showed an increase of 38 per cent over the corresponding period of last year. Since the middle of 1933 there has been a decided upswing in British industrial activity; the automotive industry has been particularly active, production figures for 1933 establishing an all-time high record.

German Machinery Trade During January and February, 1934

MACHINE CLASS	IMPORTS				EXPORTS			
	Metric Tons	Value in 1,000 R.M.	Metric Tons	Value in 1,000 R.M.	Metric Tons	Value in 1,000 R.M.	Metric Tons	Value in 1,000 R.M.
	January		Feburary		January		February	
Metal Working Machinery	233	642	227	547	6,951	8,565	8,996	9,421
Textile Mchry. & Access.	186	481	290	912	3,181	7,060	3,236	7,011
Agricultural Implements	113	167	189	190	1,483	1,323	1,537	1,304
Steam Locomotives & Tenders, on Rails*	...	...	...	...	388	309	13	11
Prime Movers	184	490	1,911	4,126	2,375	6,022	1,795	4,450
Pumps, Compressors, Fans, Blowers	70	173	63	195	509	1,355	511	1,405
Foundry, Steel and Rolling Mill Equipment†	...	...	...	...	...	...	...	...
Mechanical Conveying Equipment & Scales	44	32	166	136	1,665	1,473	700	820
Paper and Printing Mchry.	27	86	31	93	1,249	2,358	1,054	2,163
Mchry. for the Foodstuffs & Chemical Industry	33	36	8	11	579	627	545	858
Crushing & Ore Processing Equipment	39	43	40	43	634	551	490	453
Other Mchry. & Parts	295	769	350	955	4,330	8,662	4,393	8,786
Apparatus†	...	...	...	...	...	...	...	...
Total	1,224	2,919	3,275	7,208	23,344	38,305	23,270	36,682

*Official foreign trade statistics of the German Statistical Office do not classify locomotive parts separately and these are therefore included in prime movers.

†Foreign trade figures for these groups cannot be determined since these products are listed under other groups and under other statistical classifications than those covering machinery.

CORPORATION • REPORTS •

Allis-Chalmers Mfg. Co.
First quarter, net loss $677,153; first quarter, 1933, net loss $869,986.

American Machine & Metals Co.
First quarter, net loss $39,968; first quarter, 1933, net loss $368.

Baldwin Locomotive Works
Year ended March 31, net loss $3,769,587; previous fiscal year, net loss $4,080,571.

Bendix Aviation Corp.
March quarter, net profit $758,977; first quarter, 1933, net loss $267,463.

Borg-Warner Corp.
First quarter, net profit $865,093; first quarter, 1933, loss $381,981.

Caterpillar Tractor Co.
Four months, profit $1,154,393; April, net profit $366,916; April, 1933, loss $87,896.

Chicago Pneumatic Tool Co.
March quarter, net profit $24,761; first quarter, 1933, net loss $187,539.

Compo Shoe Machinery Corp.
First quarter, net profit $75,800; first quarter 1933, net profit $65,500.

Eureka Vacuum Cleaner Co.
First quarter, net profit $66,038; March quarter, 1933, net profit $944.

Ex-Cell-O Aircraft & Tool Corp.
To March 31, net profit $136,076; first quarter, 1933, net loss $58,830; preceding quarter, net profit $118,952.

Federal Screw Works
First quarter, net profit $19,656; first quarter, 1933, net loss $112,460.

Gabriel Co.
March quarter, net loss $24,496; first quarter, 1933, net loss $28,865.

Hoskins Mfg. Co.
March quarter, net profit $63,787; first quarter, 1933, net profit, $3,711.

Hudson Motor Car Co.
For March quarter, net loss $892,845; first quarter, 1933, net loss $1,491,005.

International Nickel Co.
First quarter, net profit $5,049,275; first quarter, 1933, net loss $80,158; final quarter, 1933, net profit $4,026,564.

Marlin-Rockwell Corp.
First quarter, net profit $99,380; first quarter, 1933, net loss $53,796.

Miehle Printing Press & Mfg. Co.
For 1933, net loss $548,112; for 1932, net loss $776,193.

Moto Meter Gauge & Equipment Co.
First quarter, net profit $190,839; first quarter, 1933, net loss $59,513.

Motor Wheel Corp.
March quarter, net profit $269,172; first quarter, 1933, net loss $227,578.

Mullins Mfg. Corp.
First quarter, net profit $61,549; first quarter 1933, net loss $126,469.

Muskegon Motor Specialties Co.
First quarter, net profit $9,317; first quarter, 1933, net loss $39,580.

Outboard Motors Corp.
Six months ended Mar. 31, net loss $70,095; like period, ended March 31, 1932, net loss $122,572.

Trico Products Corp.

First quarter, net profit $550,769; March quarter, 1933, net profit $170,756.

Walworth Co.

First quarter, net profit $101,244; first quarter, 1933, net loss $488,229.

Westinghouse Air Brake Co.

First quarter, net loss $271,723; first quarter, 1933, net profit $17,290.

• EXPORT • OPPORTUNITIES

Reginald C. Gout, Passage Spiromiliou 2, (Metohikon Tamion Straton), Athens, Greece, desires catalogs and prices C.I.F. Piraeus, Greece, on machinery for manufacturing motor-car gaskets—cylinder head and exhaust manifold.

H. S. Fregoso, Reforma, No. 153, Mexico, D.F., wants catalogs of machinery to manufacture brake lining. He wishes to establish a small factory.

J. H. Pahl, American Chamber of Commerce, Unter den Linden 56, Berlin, N.W. 7, Germany, desires information for a prospective purchaser of machinery that "peels" logs for production of thin boards for making boxes and cases.

The Dublin Equipment Co., 14 Merchants, Quay, Dublin, Irish Free State, is inquiring for machinery capable of making wood skewers, 4½ to 16 in. long. (Custom duty free.)

*No. 7391. Brisbane, Australia. Compressors, condensers, pressure valves and brine tanks for electric refrigerators of low price.

*No. 7405. Prague, Czechoslovakia. File re-cutting machines.

*No. 7413. Calcutta, India. Sawmilling and woodworking machinery, especially machinery for railway carriage building.

*No. 7409. Alicante, Spain. Centrifugal pumps, electric, for irrigation; and motor-driven sulphur spraying machines.

*No. 7384. La Paila, Colombia. Watertube boilers, 500 horsepower, to burn bagasse.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Dept. of Commerce, Washington, or any district or cooperative office.

• PERSONALS •

B. D. KUNKLE, president and general manager of the Delco Products Division, General Motors Corp., has been appointed assistant to C. E. WILSON, vice-president of the corporation, in charge of accessory manufacturing divisions, with headquarters at Detroit.

FRANK H. PRESCOTT succeeds Mr. Kunkle as president and general manager of Delco Products. Since January 1, 1933, he has been president and general manager of the Guide Lamp Corp., Anderson, Ind., another division of General Motors, and previously had been chief engineer of the Remy Electric Co.

CHARLES B. CUSHWA has been made president of the Commercial Shearing & Stamping Co., Youngstown, Ohio. Mr. Cushwa succeeds the late GEORGE F. ALDERDICE.

RICHARD D. PERRY, JR., has been elected president and general manager of the Perry-Fay Co., Elyria, Ohio. He succeeds his father, the late Richard D. Perry, Sr.

DR. NORMAN E. WOLDMAN, formerly metallurgical engineer for the Westinghouse Electric & Mfg. Co., has opened a consulting chemical and metallurgical laboratory at 10616 Euclid Ave., Cleveland, under the name "Crystal Engineering Laboratories."

• OBITUARIES •

SILAS H. ALTORFER, 50, president of Altorfer Brothers Co., washing machine makers, died May 14.

FRANK W. ADAMS, JR., representative for several years for the Ex-Cell-O Aircraft & Tool Corp., Detroit, died at Dayton on April 21.

Anton Goemann, 47, for fourteen years superintendent of Julian P. Friez & Sons, manufacturers of scientific instruments, Baltimore, Md., died May 7.

HUGO F. KLAUS, president of Klaus & Co., machinists and engineers, Newark, N. J., died recently at Irvington. He was 51 years old and is said to have manufactured the first embroidery machinery made in this country.

GEORGE G. MCKAY, president of the McKay Machine Co., Youngstown, Ohio, died May 6 at the age of 70.

PAUL NORTH, retired president of the former Chamberlain Target & Cartridge Co., and a director of the Ferry Cap & Screw Co., Cleveland, died May 4, at the age of 76.

GEORGE P. NICHOLS, who was a partner in the firm of George P. Nichols & Brother, manufacturer of railroad machinery, until his recent retirement, died recently.

J. ASA PALMER, president and general manager of the Burt Manufacturing Co., Akron, Ohio, died May 1, at the age of 66.

RICHARD DEWITT PERRY, 77, president for 28 years of the Perry-Fay Co., Elyria, Ohio, manufacturer of screw-machine products, died May 6.

WILLIAM J. VICTORY, vice-president of the New Britain (Conn.) Machine Co., died May 4, at Bridgeport. Mr. Victory was 61 years old and had been vice-president of the company for twelve years.

• BUSINESS ITEMS •

Acheson Oildag Co., Port Huron, Mich., has changed its name to Acheson Colloids Corp., because the expansion of the business along a number of lines makes the new name more truly representative of the company's business.

Chain Belt Co., Milwaukee, Wis., has placed a stock of chains, sprockets, buckets, set collars, pillow blocks and take-ups at its Detroit warehouse and has moved the office to 5169 Martin Ave., adjacent to the warehouse. C. E. MARTIN continues in charge.

Hevi Duty Electric Co., Milwaukee, Wis., has appointed L. A. SHEA as district representative for Ohio, with offices at 5005 Euclid Ave., Cleveland.

Esco Engineering Service Co., Toledo, Ohio, has appointed H. G. WILSON and P. L. KEACHIE, 614 Stephenson Bldg., Detroit, Mich., as representatives for drill fixtures.

Cap Screw & Nut Co., of America, Inc., moved its New York office and warehouse on May 1, from 15 to 21 Desbrosses St., New York, where larger floor space is available.

• MEETINGS •

THE AMERICAN ELECTRO-PLATERS' SOCIETY. Convention, June 11-14, Statler Hotel, Detroit, Mich. T. C. EICHSTAEDT, secretary, Statler Hotel, Detroit.

AMERICAN MANAGEMENT ASSOCIATION. Annual general management conference, May 24-25. Hotel Pennsylvania, New York. JOHN W. GOETZ, managing director, 20 Vesey St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Summer meeting, June 25. Cosmopolitan Hotel, Denver, Colo. CALVIN W. RICE, secretary, 29 West 39th St., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 25-29. Chalfonte-Haddon Hall, Atlantic City, N. J. A. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, June 17-22. Saranac Inn, Saranac Lake, N. Y. JOHN A. C. WARNER, secretary, 29 West 39th St., New York, N. Y.

American Machinist — REFERENCE BOOK SHEET ©

Sizes of Standard Milling Cutters—III

Spiral Cut End Mills With Morse Taper Shanks

[Carbon and high-speed steel. Considered standard with right-hand cut and right-hand spiral flutes. Left-hand end mills are special.]

Diameter	Number of M. T. Shank	Length of Cut	Length Overall
1/4	1	5/8	3 1/2
5/16	1	11/16	3 5/8
3/8	1	3/4	3 3/4
7/16	1	7/8	3 13/16
1/2	1	15/16	4
1/2	2	1	4 5/8
5/8	2	1 1/8	4 3/4
3/4	2	1 1/4	5
3/4	3	1 1/4	4 15/16
7/8	2	1 7/16	5 3/4
7/8	3	1 7/16	5 1/8
1	2	1 5/8	5 15/16
1	3	1 5/8	6 1/16
1 1/8	3	1 3/4	6 5/16
1 1/4	3	2	

Spiral Cut End Mills With Brown & Sharpe Taper Shanks

[Carbon and high-speed steel. These end mills are considered standard with either right-or left-hand cut. Right-hand mills have right-hand spiral flutes and left-hand mills have left-hand spiral flutes. Mills with No. 5 B. & S. taper shank are regularly furnished without tang. Mills with No. 9 B. & S. taper shank are considered standard with either tang end or with shank tapped for draw-in bolt.]

Diameter	B. & S. Taper Shank	Length of Cut	Length Overall	Diameter	B. & S. Taper Shank	Length of Cut	Length Overall
1/4	5	5/8	2 13/16	3/4	7	1 1/4	5 1/4
5/16	5	11/16	2 7/8	7/8	7	1 5/16	5 5/16
3/8	5	3/4	2 13/16	1	7	1 5/8	5 5/8
7/16	5	7/8	3 1/16	1 1/8	9	1 3/4	7
1/2	5	15/16	3 1/8	1 1/4	9	2	7 1/4
1/2	7	15/16	4 1/16	1 1/2	9	2 1/4	7 1/2
9/16	7	1	5	1 3/4	9	2 1/2	7 3/4
5/8	7	1 1/8	5 1/8	2	9	2 3/4	8

Straight-Shank End Mills

[Carbon and high-speed steel. These end mills are considered standard with either right-or left-hand cut. Diameter of the shank is the same as the diameter of the cut. Straight-shank end mills under 1/4 in. in diameter have straight flutes. In sizes 1/4 in. and over, right-hand mills have right-hand spiral flutes, and left-hand mills have left-hand spiral flutes.]

Diameter	Length of Cut	Length Overall	Diameter	Length of Cut	Length Overall
1/8	5/16	1 1/4	3/8	3/4	1 13/16
5/32	5/16	1 1/4	7/16	7/8	2 3/16
3/16	1/2	1 3/8	1/2	1 1/16	2 1/4
7/32	9/16	1 5/8	9/16	1	2 5/16
1/4	5/8	1 11/16	5/8	1 1/8	2 1/2
5/16	11/16	1 3/4	3/4	1 1/4	2 5/8

Screw-Slotting Cutters

[Carbon-steel screw-slotting cutters are not ground on the sides.]

Thickness of Cutter, American Wire Gage	Thickness of Cutter	Diameter of Cutter	Carbon Steel — Size of Hole	High-Speed Steel — Size of Hole
5	0.182	2 3/4	1	...
6	0.162	2 3/4	1	1
7	0.144	2 3/4	1	1
8	0.128	2 3/4	3/4, 1	3/4, 1
9	0.114	2 3/4	3/4, 1	3/4, 1
10	0.102	2 3/4	3/4, 1	3/4, 1
11	0.091	2 3/4	3/4, 1	3/4, 1
12	0.081	2 3/4	3/4, 1	3/4, 1
13	0.072	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
14	0.064	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
15	0.057	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
16	0.051	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
17	0.045	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
18	0.040	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
19	0.036	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
20	0.032	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
21	0.028	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
22	0.025	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
23	0.023	2 3/4	1/2, 5/8, 3/4, 1	3/4, 1
24	0.020	2 3/4	1/2, 5/8, 3/4, 1	...
25	0.018	2 3/4	3/4, 1	...
26	0.016	2 3/4	3/4, 1	...
27	0.014	2 3/4	3/4, 1	...
28	0.013	2 3/4	3/4, 1	...
30	0.010	2 3/4	3/4, 1	...
32	0.008	2 3/4	3/4, 1	...
34	0.006	2 3/4	3/4, 1	...
10	0.102	2 1/4	5/8	...
11	0.091	2 1/4	5/8	...
12	0.081	2 1/4	5/8	...
13	0.072	2 1/4	5/8	5/8
14	0.064	2 1/4	5/8	5/8
15	0.057	2 1/4	5/8	5/8
16	0.051	2 1/4	5/8	5/8
17	0.045	2 1/4	5/8	5/8
18	0.040	2 1/4	5/8	5/8
19	0.036	2 1/4	5/8	5/8
20	0.032	2 1/4	5/8	5/8
21	0.028	2 1/4	5/8	5/8
22	0.025	2 1/4	5/8	5/8
23	0.023	2 1/4	5/8	5/8
24	0.020	2 1/4	5/8	...
25	0.018	2 1/4	5/8	...
26	0.016	2 1/4	5/8	...
27	0.014	2 1/4	5/8	...
28	0.013	2 1/4	5/8	...
30	0.010	2 1/4	5/8	...
32	0.008	2 1/4	5/8	...
34	0.006	1 3/4	5/8	5/8
14	0.064	1 3/4	5/8	5/8
15	0.057	1 3/4	5/8	5/8
16	0.051	1 3/4	5/8	5/8
17	0.045	1 3/4	5/8	5/8
18	0.040	1 3/4	5/8	5/8
19	0.036	1 3/4	5/8	5/8
20	0.032	1 3/4	5/8	5/8
21	0.028	1 3/4	5/8	5/8
22	0.025	1 3/4	5/8	5/8
23	0.023	1 3/4	1/2, 5/8	5/8
24	0.020	1 3/4	1/2, 5/8	...
25	0.018	1 3/4	1/2, 5/8	...
26	0.016	1 3/4	1/2, 5/8	...
27	0.014	1 3/4	1/2, 5/8	...
28	0.013	1 3/4	1/2, 5/8	...
30	0.010	1 3/4	1/2, 5/8	...
32	0.008	1 3/4	1/2, 5/8	...
34	0.006	1 3/4		

American Machinist

REFERENCE BOOK SHEET ©

Sizes of Standard Milling Cutters—IV

Simplified Practice Recommendation R36-34, Milling Cutters, as revised by the industry and issued by the National Bureau of Standards, effective April 15, 1934.

Involute Gear Cutters

[Carbon, and high-speed steel. Involute gear cutters can be sharpened without changing their outline.]

Eight cutters are made for each pitch, as follows:

No. 1 will cut gears from ..... 135 teeth to a rack.
No. 2 will cut gears from ..... 55 teeth to 134 teeth.
No. 3 will cut gears from ..... 35 teeth to 54 teeth.
No. 4 will cut gears from ..... 26 teeth to 34 teeth.
No. 5 will cut gears from ..... 21 teeth to 25 teeth.
No. 6 will cut gears from ..... 17 teeth to 20 teeth.
No. 7 will cut gears from ..... 14 teeth to 16 teeth.
No. 8 will cut gears from ..... 12 teeth to 13 teeth.

Standard Hole

Diametral Pitch	Diameter of Cutter	Size of Hole	Diametral Pitch	Diameter of Cutter	Size of Hole
*1	8½	2	12	2¼	⅞
*1¼	7¾	2	14	2⅛	⅞
*1½	7	1¾	16	2⅛	⅞
1¾	6½	1¾	18	2	⅞
2	5¾	1½	20	2	⅞
2½	5¾	1½	22	2	⅞
3	4¾	1¼	24	1¾	⅞
4	4¼	1¼	26	1¾	⅞
5	3¾	1¼	28	1¾	⅞
6	3⅛	1	30	1¾	⅞
7	2⅞	1	32	1¾	⅞
8	2⅞	1	36	1¾	⅞
9	2¾	1	40	1¾	⅞
10	2⅜	⅞	48	1¾	⅞
11	2⅜	⅞			

Cutters marked * are not kept in stock, but are made to order.

1-In. Hole

4	3⅝	1	16	2½	1
5	3⅜	1	18	2⅜	1
10	2¾	1	20	2⅜	1
11	2⅝	1	22	2¼	1
12	2⅝	1	24	2¼	1
14	2½	1			

1¼-In. Hole

6	3½	1¼	9	3⅛	1¼
7	3⅜	1¼	10	3	1¼
8	3¼	1¼	12	2⅞	1¼

1½-In. Hole

3	5¼	1½	6	3⅞	1½
4	4½	1½	7	3⅝	1½
5	4¼	1½	8	3½	1½

1¾-In. Hole

2	6½	1¾	4	4¾	1¾
2½	6⅛	1¾	5	4⅜	1¾
3	5⅝	1¾	6	4¼	1¾

For Mitre and Bevel Gears—Standard Hole

3	4	1¼	10	2⅜	⅞
4	3⅝	1¼	12	2¼	⅞
5	3⅜	1¼	14	2⅛	⅞
6	3⅛	1	16	2⅛	⅞
7	2⅞	1	20	2	⅞
8	2⅞	1	24	1¾	⅞

Metric Sizes—Standard Hole

Module in Millimeters	Diameter of Cutter	Size of Hole	Module in Millimeters	Diameter of Cutter	Size of Hole
½	1¾	⅞ or 22m/m	4¼	3⅛	1 or 27m/m
¾	1¾	⅞ or 22	4½	3¾	1¼ or 32
1	1¾	⅞ or 22	4¾	3¾	1¼ or 32
1¼	2	⅞ or 22	5	3¾	1¼ or 32
1½	2⅛	⅞ or 22	5¼	3¾	1¼ or 32
1¾	2⅛	⅞ or 22	5½	4	1¼ or 32
2	2¼	⅞ or 22	5¾	4	1¼ or 32
2¼	2⅜	⅞ or 22	6	4¼	1¼ or 32
2½	2⅜	⅞ or 22	7	4½	1¼ or 32
2¾	2¾	1 or 27	8	4¾	1¼ or 32
3	2⅞	1 or 27	9	5½	1½ or 40
3¼	2⅞	1 or 27	10	5¾	1½ or 40
3½	2⅞	1 or 27	11	5¾	1½ or 40
3¾	2⅞	1 or 27	12	5¾	1½ or 40
4	3⅛	1 or 27	....	....	.....

1-In. or 27-m/m Hole

1	2¼	1 or 27m/m	2½	2¾	1 or 27m/m
1¼	2⅜	1 or 27	4½	3¼	1 or 27
1½	2½	1 or 27	5	3⅜	1 or 27
1¾	2½	1 or 27	5½	3½	1 or 27
2	2⅝	1 or 27	6	3⅝	1 or 27
2¼	2⅜	1 or 27	...	...	.....

1¼-In. or 32-m/m Hole

2	2⅞	1¼ or 32m/m	3	3¼	1¼ or 32m/m
2¼	2⅞	1¼ or 32	3½	3⅜	1¼ or 32
2½	3	1¼ or 32	4	3½	1¼ or 32

1½-In. or 40-m/m Hole

3	3½	1½ or 40m/m	5½	4⅜	1½ or 40m/m
3½	3⅝	1½ or 40	6	4½	1½ or 40
4	3⅞	1½ or 40	7	4⅞	1½ or 40
4½	4⅛	1½ or 40	8	5¼	1½ or 40
5	4¼	1½ or 40	...	...	.....

1¾-In. or 45-m/m Hole

4	4¼	1¾ or 45m/m	8	5⅝	1¾ or 45m/m
4½	4⅜	1¾ or 45	9	5⅞	1¾ or 45
5	4⅜	1¾ or 45	10	6⅛	1¾ or 45
5½	4⅝	1¾ or 45	11	6½	1¾ or 45
6	4¾	1¾ or 45	12	6½	1¾ or 45
7	5¼	1¾ or 45	.....	.....	.....

THE ROUND TABLE

False Security

"Hello, Al, how're things going?"

"Fine, Ed. Our business is about normal now."

"I got the impression that you were slack. I met one of your men over the week-end, and in the course of the conversation I asked him how he liked working where he was. He said 'not so good—I always expect to find a blue slip in my pay envelope. None of the boys seem sure of their jobs.' I asked him why that was, and he said it was your attitude that made him worry."

"I don't know who you talked to, but I think I know what's on his mind. Maybe I've gone a little too far."

"In what way?"

"I believe that the idea of permanent employment that was preached before the depression was wrong and that it lulled men in a security that was disastrous."

"How do you make that out?"

"Well, it gave them a sense of security that proved false. It committed them to a scale of living that was not justified. They bought cars and electric refrigerators, built houses and equipped them with furniture they could not afford, all on the assumption that they had a steady income from which to meet installment payments when due. Communists rave about the crime against the 'worker,' but it strikes me that these agitators have their eye on the wrong crime."

"Bosh, Al. There just weren't enough good men to go around, and when a manufacturer got hold of one he tried to hang on to him."

"That was partly it, Ed. You and I were both guilty of feeding our men a lot of bunk along that line. The rest of the fault lies in having professional labor hirers. Like all professionals they cooked up sales talks and permanency propaganda to illustrate how much better they were than the common run of superintendents who usually did the hiring."

"Well, they had their troubles, Al."

"Yes, and so did we with the men they hired. I wasn't in business then, or I'd have probably done the same thing, but as it is I am not going to make the big mistake of inducing my men to run into debt because they think they have a permanent job."

"What are you going to do—fire them just to show them that their job is not permanent?"

"No, but I'll get after them to bank their money. Maybe I'll duplicate the interest the bank pays, just to make saving more attractive. Three per cent isn't very much."

"No, neither is twenty-five per cent to the average workman. I don't think the merchants of the town will agree with your idea, Al, and I don't think the men will. Furthermore, I don't believe you can put it over. Men don't like being told to save."

"Yes, I know that. You can't tell them anything, and you can't do anything for them unless it's a free gift. But I'll find some way to make them save."

"I'm afraid you're taking too much on yourself, Al. The man earns the money and if he can't have the pleasure of spending it, why earn it?"

"To provide for the future for one thing. If I can't do anything else, I can make a man's bank book the chief factor in any bonus I pay him."

"That would be mean, Al."

"Mean or not, I'll resort to it if necessary. We pay a liberal wage, sufficient for a man and his family to live on. If he can't save something, he is wasting some of it. There's no use throwing a good bonus after a badly spent wage."

Is Al's idea sound? How can he best work it?

Discussion

Unions—Horizontal or Vertical?

The so-called horizontal union will always attract the best type of member for the following reason. The fact that a workman has served an apprenticeship at his craft, and in consequence has acquired a reasonable degree of skill and a certain amount of reasoning capacity, seems to make for a steadiness which his less skilled brother lacks. The higher skilled workman is usually opposed to merging into the vertical union, not because of any caste feeling, but because—to cite an illustration—as a skilled toolmaker perhaps, he might be asked to strike in sympathy with the drill-press hand who seeks an advance in piecework prices. Such a man, while having some measure of sympathy for the lower skilled workman, feels no obligation to put that sympathy into action by "walking out" on an employer who has recognized the toolmaker's higher skill by paying him the prevailing wage rate for his district.

The only way a vertical union can secure more stability in a shop, is by grading the workmen according to their

skill and negotiating with management on this basis.

Finally, the only alternative to unions is a condition whereby industry will be conducted on a cards-on-the-table basis so that employers will be guaranteed a fair day's work and employees a living wage.

Until then the unions will persist.

—Robert S. Alexander.

Employers have learned that if they band together, the best way is with a united front. Their essential interests are the same. Their essential program is similar. Therefore, they unite so that no individual or small group of individuals can disrupt them by sporadic independent action.

Labor on the other hand, has not had a chance to develop into a usable unit because of the difference of trades within an industrial unit. Because of this difference of unions, labor strikes mean little except extreme harm for both sides.

Suppose, however, that strikes had to be called by a union for the entire industry. Would half of those we have today exist? If the strikes could not be called without the consent of the rest of the units, arbitration would be possible. Examples of arbitration thus far have almost always been worth noting. There is still room for much more work to be done in this line.

Type of union? Vertical decidedly. Only the vertical union which will unite warring labor factions and which will decrease unneeded strikes can bring the real benefits of sensible and sensibly wielded unionism, whether it be that of employers or employees.

—Morry Tanenbaum.

Any union which fails specifically to recognize and differentiate between different classes of mechanics on different intelligence or skill levels is foredoomed to failure. The craft union does this to a great extent. However, even in the craft (or horizontal) union there is a leveling influence which is one of its most peculiar aspects.

The grievance of many employers of labor against unions is not so much in the fact that the union seeks to obtain for the employee all that is his due, but rather in the leveling influence of the union as touching employees. As a member of a union, the loud-mouthed, swaggering and poorly-trained mechanic waxes loud in his support because it places him on a much higher plane relatively than that on which he belongs.

If this particular weakness of the union could be avoided, it would receive much greater support from really skilled mechanics. The highly trained mechanic, with years of careful study and experience as a background, cannot help resenting, in spite of himself, the placing of inefficient men on his own level.

Reasoning from this standpoint, the horizontal union is by far the better in any shop where different classes of mechanics are working. In a shop where practically all of the mechanics rate at about the same level, the vertical union might prove satisfactory.

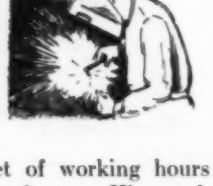
It is to be regretted that a greater degree of education concerning the costs of doing business cannot be disseminated among workmen in such a manner as to enable those who are less intelligent to understand it better. Talk to some of overhead, of interest on investment or of depreciation of equipment, and they will consider these terms some sort of mysterious camouflage aimed at diverting a part of what is rightfully theirs into company coffers. Most working men are inherently fair, and many of those who strike against their own best interests, at times, honestly believe it to be the right and proper thing to do. But the ideal solution to these things has not yet come to light.

—John E. Hyler.

NRA and the Small Shop

On the whole, I'm inclined to believe that the small shop has been given the worst end of the deal by the NRA.

A large concern is working on an efficient and routine plan. The code has effected little vital change. But the small shop works in a sort of irregular, haphazard fashion. It has little knowledge of what the orders will be several months or even weeks from a particular day. The small shop works at top speed one week; another week all hands are fairly idle. Trying to make the small shop conform to a particular code, a



definite set of working hours is unfair to the employer. His work will not permit him to work on a regular routine.

Although it is true that prices have been evened out, the small shop has gained little. Prices are even and uniform for the small and large plant only on individual pieces. There are still the regular discounts and benefits of buying in quantity lots. The large firm can afford to do so; the small shop finds itself in the same position. It pays the uniform rate because it buys in small lots but this uniform rate is much higher than the rate for the large plant. This is evident.

It is true that the small shops have a proportionate say in the making of the code, but actually, the larger plants make the code. This is due to lack of time, lack of money, and in many cases, lack of interest. The large plants have little difficulty in having things their own way; the small shop, as usual, finds itself in the under-dog position.

—Will Herman, *Superintendent, Tanenbaum & Son Oil Company.*

What Share?

Sharing profits is as old as industry, but more often than not, the sharing is done by those who need it least and ofttimes deserve it least. What is more likely than this, inasmuch as the management of industry determines whether or not to share, and with whom? So we know that unsatisfied labor is not starting a precedent by asking that profits be shared; the only precedent is that labor be allowed to share some of the profits. A bonus to labor appears the fair thing.

Neither management nor labor can be paid proportionately to industrial earnings, any more than industrial earnings can be guaranteed by the amount paid to labor or to management. A brief glance over the past four years is proof of this. Millions of men were paid regularly from a surplus set up in previous years. Industry was down; if men were paid proportionately to industrial earnings, they would have been paying for the privilege of working. Yet these men were paid from the earnings of others, and no one questions the fairness of that.

The company's earnings, above the amounts required for wages, salaries, dividends, machinery replacement and other expenses, as now calculated, should go toward a surplus for carrying through in days of stress. The earnings of labor should be based on what is demanded of it. If the demand is physical effort that wrecks the human machine in fifteen years, pay accordingly, or better yet, remove the necessity for that kind of labor; if skilled labor that requires ten or twelve years to acquire knowledge and skill, pay accordingly; if clerical, official, janitor, or executive, pay accordingly and fairly.

But do not pay according to industrial earnings. Labor has what industry needs, and industry has what labor needs; but apparently industry has not given to labor proportionately to what labor has given to industry. Evidence of this is workless men and bulging warehouses.

—John J. McHenry.

NEW BOOKS

★ ★ ★

PROCEDURE HANDBOOK OF ARC WELDING, DESIGN AND PRACTICE. *450 pages, 5¾x9 in. Flexible binding. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, $1.50.*

In this second edition new material has been included on weld inspection, photo-elastic stress analysis, butt welds, and design methods. Stethoscopic, electromagnetic, X-ray and gamma-ray inspection methods are briefly described in a seven-page section. A 4-page addition describes photo-elastic methods for determining stress concentration, and illustrates the effect of various types of welds on stress distribution. Detail drawings are included for an inexpensive mirror polariscope suitable for analyzing stresses.

★

THE TURNING WHEEL. *The story of General Motors through twenty-five years, 1908–1933. By Arthur Pound. Illustrated by William Heyer. 517 pages, 6x9 in., including an index. Published by Doubleday, Doran & Company, Inc., Garden City, N. Y. Price $3.50.*

Mr. Pound has done an excellent job in tracing the development of the modern automobile which has been practically synonymous with the development of the General Motors Corporation. The part played by each of the constituent units in the growth of this great enterprise is described, and the contributions of the various individuals involved are told with due attention to the human interest features.

The automobile and the organizations that build it stand as proud evidence of American inventive and constructive genius. Both are so closely tied up with the metal-working industry as a whole that this history should appeal to those connected with the industry.

★

THE NEW CAPITALISM. *By James D. Mooney, President, General Motors Export Corp., 329 pp., 6x9 in. Illustrated. Published by the Macmillan Company, New York. Price $3.50.*

The average man has grown so accustomed to look upon economics as a subject too baffling and involved to understand that he should welcome this book. It reduces the whole subject to simple fundamental principles and truths.

What "The New Capitalism" envisages is a new and reformed order, attuned to the spirit of the Constitution, which in the final analysis says: "What I work for and save is mine." The quotation sums up the author's main argument toward an ideal economic America, an argument he supports with scientific and engineering analogies.

The development of the argument for the "New Capitalism," and against any system of government and industry which runs counter to such laws as those of "Supply and Demand" proceeds in an orderly and convincing style, with the aid of hydraulic analogies. The method of illustration is unusually effective.

A Task for Old Timers Discussion

OTTO A. WAGNER

L. I. Yeoman's article (*AM*—Vol. 78, page 280) contains more sound sense than I have read in a long time. There are many youths of today who would profit much by such an arrangement and the trades are going to need them. The old men would enjoy it, and the feeling of being able to do something for posterity would no doubt make life worth while to these old-time mechanics, so that their lives would be lengthened instead of shortened. Mr. Yeoman's idea has more merit than any other solution of the old-time mechanic's problem yet proposed. It should receive due consideration by those in a position to put it into effect.

Who Shall Do the Repair Work?—Discussion

W. R. NEEDHAM
Stafford, England

The writer agrees with C. G. Williams, (*AM*—Vol. 78, page 177), that repairs should, wherever possible be undertaken by men on the spot, rather than by men specially engaged from outside. For one thing—and it is quite a consideration—the insider should know much more about the machinery and its uses.

The good maintenance man is a logical descendent of the old-time millwright. He has initiative and can improve when necessary. Such men seem to be born rather than made. Nor are they too plentiful. They need finding; but once found, their employers are to be congratulated if and when such men are given the recognition and the encouragement their value deserves. He is a good manager who succeeds in spotting the potential repair man, and gives him his chance to make good for himself and his firm.

***Beer Cases in the Making*—(Above) After blanking and embossing, steel sheets of 18 to 24 gage are bent in a Bliss press to form the sides and ends. (Below) Each case is fabricated by 170 spot welds for which a battery of twenty-four 20-kva. Taylor-Winfield machines are employed. These operations are performed by the Murray-Ohio Manufacturing Co.**

• IDEAS •
FROM PRACTICAL MEN

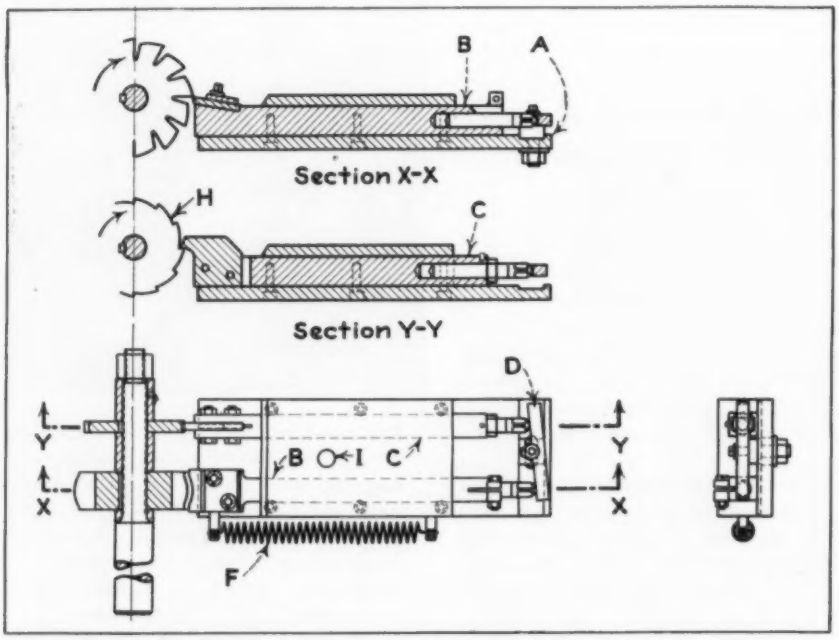
A Backing-Off Attachment

EMIL WITTMANN

In the illustration is shown an attachment that can be used in either the lathe or the milling machine for backing-off or relieving tools.

Essentially, the attachment consists of the base *A*, to which is fastened the guide for both the toolbar *B* and the actuating bar *C;* the swivel connection *D;* and the tension spring *F*. Both the work and the relieving cam *H* are held on the same mandrel. If the device is to be used in the lathe, it is attached to the base of the compound rest by a bolt through the hole *I*. If it is to be used in the milling machine, it is attached to the table by a bolt through the same hole, both the work and the relieving cam being held on the cutter arbor.

In operation, the actuating bar is moved in one direction by the relieving cam and the toolbar is moved in the opposite direction by the swivel connection, to which it is kept in contact by the tension spring. The pivot of the swivel connection can be moved to one side or the other of the center of the base, thus providing means for using a relieving cam that is different in diameter from that of the work. The tool is fed into the work with a screw, the head of which is squared for a wrench and bears against one end of the swivel connection. The tapped end of the toolbar is slotted and is provided with a binding screw to pinch the feed screw.



Shops not provided with relieving lathes, or that have such machines which are overloaded at times, will find this attachment very convenient

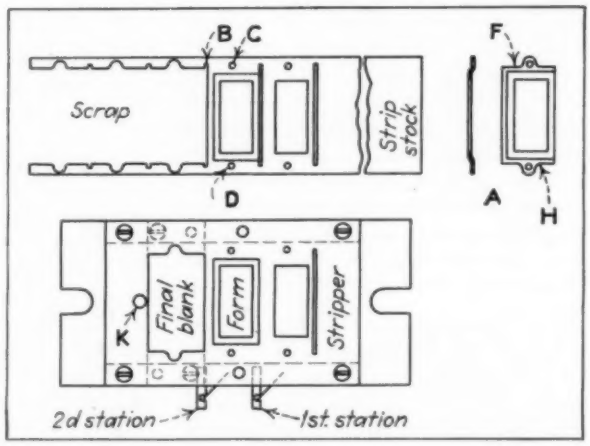
Die for Card Holders

WILLIAM GIBBONS

We recently made the die illustrated for forming and blanking card holders such as the one shown at *A*. The punches have been omitted for the sake of clearness. Anyhow, most of the *American Machinist* readers are mechanics and know that punches are made to suit the dies.

Since the forming takes place before the final blanking, the blanking must be done in such a way as not to distort the formed piece. The slot *B* and the two holes *C* and *D* are pierced in the strip stock at the first down stroke of the ram, and the final blanking is done by cutting the ends *F* and *H* of the holders.

The strip stock is brought into contact with the stop at the first station and is pierced, slotted and the rectangular piece in the center is blanked. The stock is then advanced to the stop at the second station, where forming takes place. At this station, pilots in the punch-holder enter the pierced holes and prevent the stock from shifting during forming. The strip is then advanced to the stop *K*, where final blanking takes place. Afterward, a complete holder is produced at each stroke.



Final blanking is done after forming, the cuts being at the ends only so as not to distort the formed piece

Quantity Methods in Figuring

J. I. HOMMEL
Standards Engineer
Westinghouse Electric & Mfg. Co.

Whenever the average accuracy resultant from slide-rule readings is insufficient and it is found necessary to carry out long-hand multiplication, it will prove to be convenient to use suitable multiplication tables.

Suppose the weight in pounds per lineal inch of german-silver wire weighing 0.314 lb. per cu.in. is to be obtained.

It will take but a few minutes to prepare the following table:

1	cu. in.	=	0.314 lb.
2	"	=	0.628 "
3	"	=	0.942 "
4	"	=	1.256 "
5	"	=	1.570 "
6	"	=	1.884 "
7	"	=	2.198 "
8	"	=	2.512 "
9	"	=	2.826 "

If wire $\frac{13}{32}$ in. in diameter is to be used, its area is 1.296 sq.in., and to find its weight per lineal inch, the weight per cubic inch is multiplied by the area. To save time, instead of multiplying the quantities direct, jot down from the above table the results of the weight per cubic inch multiplied by the various digits of the area and add them together as follows:

6 =	1884
9 =	2826
2 =	628
1 =	314
	0.406944 lb. per lineal inch.

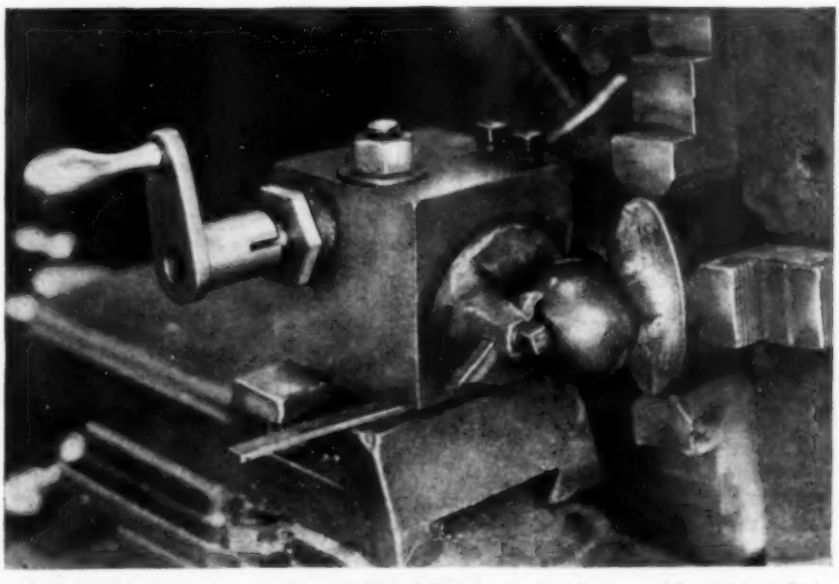
The use of such tables saves time in computation, saves brain work and practically eliminates errors that are almost unavoidable in repeated individual multiplication.

Ball-Turning in the Lathe

FRANK C. HUDSON

There are numerous ways of turning balls in a lathe. The illustration shows a simple form or radius tool operation in the turning of balls for hand rails and similar work at the Newport News Shipbuilding Company.

The tool holder is almost a cube, with a small tool post at one end of the flanged shaft shown. A small worm wheel is cut on the other end of the shaft and is operated by the crank driven worm at the back.



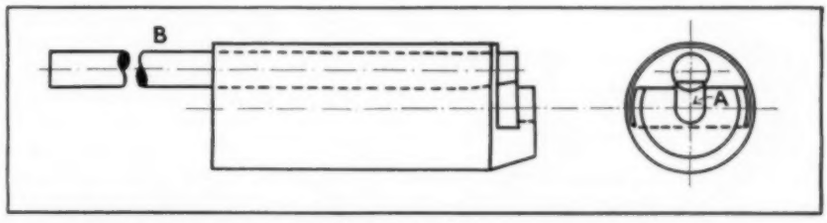
By this simple method a nearly complete ball may be made in a wide variety of sizes

Holder for Rethreading Bolts

CHARLES GASSER

In shops where sheet-metal articles are fabricated by riveting, it is necessary to use fitting-up bolts to hold the work together before riveting. These bolts are of various lengths and are threaded close to their heads. Sometimes they are used but a few times before the threads become battered in places, necessitating either rethreading or scrapping.

For holding the bolts in the bolt cutter, we designed the holder illustrated, which is held in the vise of the machine. The bolts are placed in the slot *A*, close to their heads, and the rod *B* is moved forward, the tapered flat on the end engaging the heads and preventing them from turning by the pressure of the cut. The automatic stop is set to open the die before it reaches the bolt heads. We find that the bolts can be rethreaded several times before scrapping, which is quite a saving.



Rethreading battered fitting-up bolts is more economical than scrapping them. This fixture holds bolts in the bolt cutter, so they can be rethreaded close to the heads

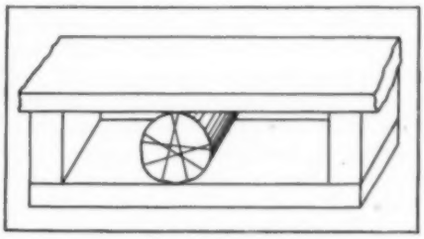
Producing Cylinders by Rolling

FRANCIS W. SHAW

Heywood, Lancashire, England

Is it possible to produce a circular-section cylinder by rolling, or by any analogous process; that is by any process in which rotation of the work is not positively controlled, as by rigid centers? The answer to this question is "No," as a little study will show.

The impossibility was interestingly demonstrated by apparatus similar to that illustrated, made and exhibited by the British National Physical Laboratory at a meeting of Royal Society at London. Every endeavor to roll a piece of plasticene to a circular cylinder failed, the shapes produced always being different. It will be seen that the pentelobe in the illustration, a possible shape, has uniform diameter and will therefore fit perfectly in any position between the rolling planes. This will give a good idea as to what would occur if a steel bar, not already perfectly circular in section, were reduced by any abrading process—say by lapping—in an attempt to make it truly circular.



While material rolled between parallel surfaces may have uniform diameters and may fit perfectly in any position between the planes, it is not necessarily round

As this same bar would fit equally well between two pair of planes, it will be realized that the error could not be eliminated in any centerless grinding machine by supporting it by a steady-rest and rotating it between the control wheel and the grinding wheel. The article "Multipoint Gages" by Harry Shaw (*AM*—Vol. 75, page 43) well illustrated that however numerous the points of support, or how distributed in

a circle, absolute reliance could not be had on the resulting form being of circular section.

The term "circular section" has been adopted because the scientific definition of a cylinder is, "A solid traced out by a straight line moving around a given curve in such a manner that it always keeps parallel to itself in its initial position." All the shapes producible are therefore cylindrical, though not necessarily of circular section. Equally, for the same reason, it is impossible, either by gaging the cylinder between parallel planes, or by any number of points arranged anyhow about a circle, to insure that it is circular. Seemingly, then, the only way to be sure is to control the rotation and to check that instead of the work.

All that has been said concerning cylindrical variations applies equally to spherical objects, as was proved by several unround spheres made by the institution mentioned above according to information furnished by the writer and his son. Though palpably out of round, steel balls in our possession were shown to be perfect spheres when gaged by a micrometer.

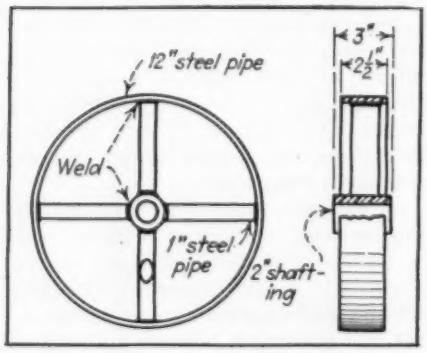
Both rollers and balls having these departures from circularity roll perfectly in their races, for they fit equally well in every angular position.

Welded Wheels for Shop Trucks

WILLIAM L. CADMAN

The continued breakage of cast-iron truck wheels was an annoying problem in the maintenance shop of a large manufacturing plant, and it was decided to try wheels fabricated from steel pipe by welding.

The rims were cut from 12-in. pipe; the spokes were made from 1-in. pipe, flattened to an oval shape; and the hubs were pieces of cold-rolled shafting. All parts were welded as shown in the illustration. Boring the hubs was the only machine work required. These wheels stood up under very severe usage on rough floors.



Wheels for shop trucks fabricated from steel pipe by welding stood up where wheels of cast iron had failed

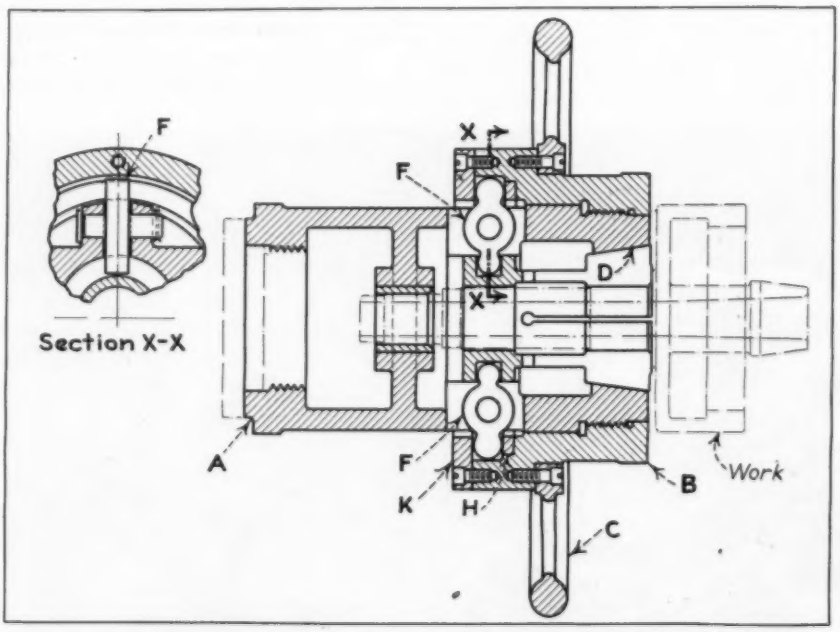
A Draw-Back Chuck

C. W. PUTNAM

Having several hundred parts to machine of the shape indicated by the heavy-dotted lines in the illustration, we decided to adopt a draw-back chuck for holding the work while boring the hole and machining the large end. Since the work was so long that it had to be supported at the inner end to keep it in alignment, it was not possible to use a draw-in rod, so we made the chuck as illustrated.

Essentially the chuck consists of the body *A;* the cap *B;* the handwheel *C;* the spring collet *D;* the two dogs *F;* the hardened washer *H;* and the hardened ring *K*. The inner end of the body is threaded to fit the spindle of the lathe, while the outer end is bored to suit the taper of the spring collet, and is turned and threaded for the cap. Also, a straight hole is bored to fit the inner end of the collet, the web being bored for a bushing to support the inner end of the work. The cap is threaded to fit the body and a seat is turned for the handwheel, which is attached with screws. The spring collet is grooved at the inner end to receive the inner ends of the dogs. Both dogs are pivoted in the center and their outer ends are held between the washer and the ring in the cap, their inner ends engaging the annular groove in the inner end of the collet.

In operation, the collet is forced forward and opened by the action of the dogs when the cap is screwed farther on the body, and is drawn in and closed on the work by screwing the cap farther off the body, the cap being operated by the handwheel.

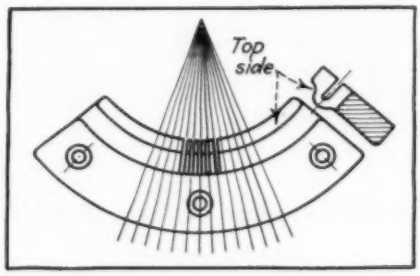


As the work was so long that it had to be supported at the inner end by a bushing in a web, it was impossible to use the conventional draw-in rod

Milling and Burring Radial Slots

C. W. HINMAN

A perplexing problem in the manufacture of typewriters is sawing and burring forty-two slots in the type-bar fulcrum segments. The illustration shows a plan of a segment and a section through one of the slots. The segments are usually of gray iron composition and are foundry cast. Die castings might be used if they would "stay put," but the



Burring the slots in this piece is complicated by the shape of the section through which the slots are sawed

segments are important parts in the successful operation of typewriters, and taking chances would be a bad risk.

The sawed slots are radial and their center lines meet at a common point, as shown. The slots are 0.040 in. wide and are usually sawed one at a time in a special indexing fixture. In some plants a stepped gang of six saws is permanently set for rotation cuts, each saw being coincident with the common radial angle in the work, and will cut six slots at each indexing. Such an arrangement is expensive to build, and its economy is in question, since it requires about as much time to index and to cut six slots in stepped rotation as it does to index and to cut the six slots singly. Leaving the slotting problem to the reader who is able to suggest a better method, the next problem is burring the slots.

While the burrs are not heavy, each slot must be entirely burr free, otherwise the forty-two type bars will not have the free fit and the equal action necessary for sensitive touch. On the top side of the segment, the slots pass through a semicircular boss, which complicates the burring operation considerably. Two thousand, or more, segments is not an unusual daily schedule in the average shop. Practically every idea suggested by tool-engineers during the past fifty years has been tried for burring the slots rapidly, economically and satisfactorily, but it is still a slow job.

Burring the Slots

Each slot is burred separately. Sometimes a moving wire belt is used in each slot, and the work is alternately tipped to free all the burrs. In some plants each slot is cleared with a crocus-cloth blade held in a hacksaw frame. The blade is alternately turned to a slight angular position while in motion, to remove the burrs from all the edges. In using either of these methods, a half-dozen bench hands are necessary, each being provided with a special vise to hold the work in several positions. Another method is to use a small, triangular-headed hand burring tool, which is a miniature duplicate of a woodworker's scraper. One point of the triangle is placed in a slot and the operator scrapes the burrs from both edges by draw cutting around three sides of the segment.

The reader may be able to suggest some better way to improve this operation, but it should be stated that removing the burrs by an acid dip is unsatisfactory. The object is to leave slight angular edges in the slots all around the three faces of the segment, because this condition permits the least interference with the best action of the type bars.

A Chuck-Tightening Indicator

N. M. MOORE
Hamilton, Ontario, Canada

When work has to be taken out of a four-jaw independent chuck, it takes considerable time and effort to put it back and get it to run true. Still this must often be done when the work is to be fitted to parts that cannot be brought to the lathe. If the work is marked to show which way it is to be put in the chuck in relation to the jaws, and the jaws are tightened the same as they were before the work was taken out, it will run true. Marking the work is easy, but not so the tightening of the jaws as before. To make the duplication of pressure possible I designed the indicating device illustrated.

The device consists of two collars; two shoulder screws, two pointers of sheet metal; and two knurled nuts. The bodies of the pointers where they fit between the collars have two circular slots. The slots in pointer No. 1 are of a width to clear the threaded portions of the shoulder screws. One slot in pointer No. 2 is of the same width as those in Pointer No. 1, the other slot being wide enough to clear the bodies of the screws. This is so that the pointers can be tightened separately. Both collars have setscrews to hold them on the chuck wrench.

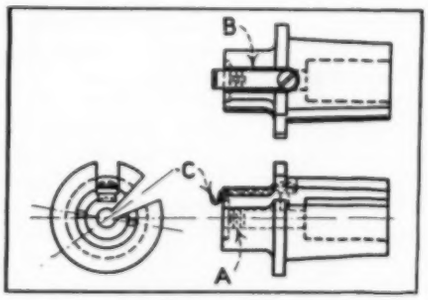
Marks are made on the periphery of the chuck opposite the screws of jaws Nos. 1 and 2 and the figures 1 and 2 are stamped on the upper collar near each shoulder screw to show to which mark each pointer is to be set. Assuming that work in the chuck is to be taken out and then put back again so that it will run true. With the indicating device on the wrench and the collars tightened by the setscrews, the wrench is put into the square hole of the screw of No. 1 jaw, with pointer No. 1 nearest the mark No. 1 on the chuck. The pointer is then turned to coincide with the mark on the chuck and is tightened by the knurled nut on shoulder screw No. 1, leaving pointer No. 2 free.

The wrench is then transferred to the screw of No. 2 jaw and the process is repeated with pointer No. 2. Chuck jaws Nos. 1 and 2 can now be loosened and the work can be taken out. In putting back the work, the screws of jaws Nos. 1 and 2 are successively tightened until the pointers are in line with their respective marks on the chuck. The pressure of the jaws on the work will then be the same as it was before the work was taken out, and the work will run true.

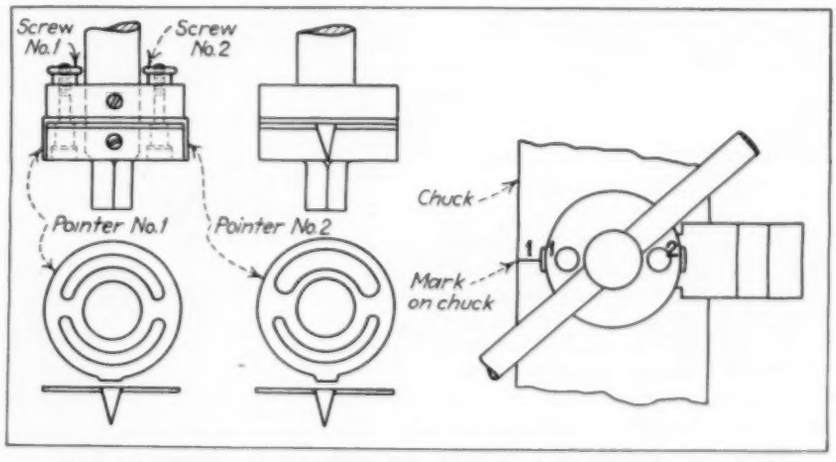
A Slotting Bushing for Use in Automatic Screw Machines

EDWIN R. KAY

The bushing illustrated is for use in the slotting attachment of the No. 00 Brown & Sharpe screw machine. Its purpose is to hold the screw to be



Screws to be slotted in automatic screw machines are held in this bushing by a flat spring while being transferred to the slotting saw



Work taken out of an independent four-jaw chuck can be put back to run true by the use of this device

slotted while it is being transferred from the cut-off operation to the slotting saw. In this case, the screw *A* to be slotted is quite small, the body being No. 4 in size, $\frac{3}{8}$ in. long and having 40 threads per in. The head is $\frac{1}{4}$ in. in diameter and 0.050 in. thick.

It is obvious that unless such small, light screws were held in the bushing by some means, there would be danger of their being washed out by the force of the stream of lubricant. The means for holding the screw is very simple. The flat spring *B* is held in a slot by a small screw. The outer end of the spring is bent into V-shape, as at *C*, and snaps over the head of the screw just as the screw is being cut off from the rod.

Two Individually-Driven Parts of a Machine Synchronized by Two Variable-Speed Drives

FRANCIS A. WESTBROOK

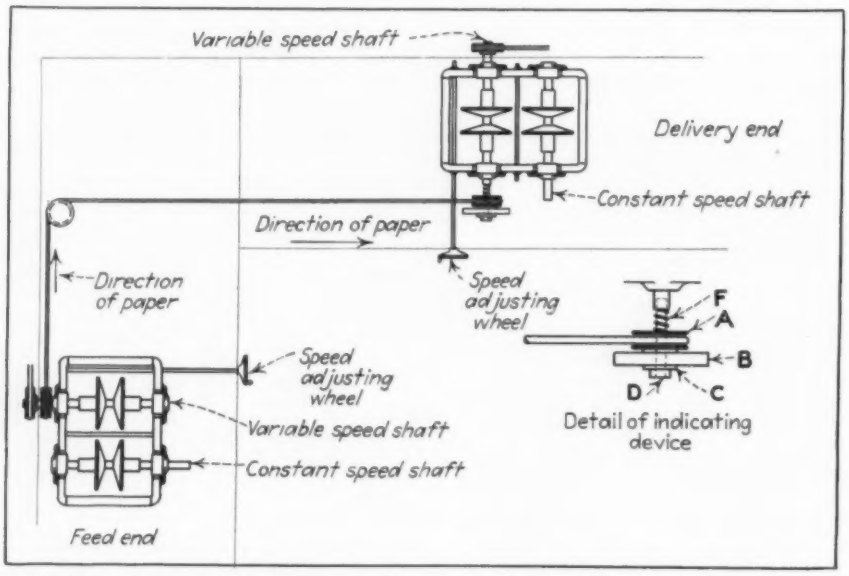
A late type of machine for ruling paper is built in two sections, the speeds of which must be very accurately synchronized. Each section is driven by an individual motor through a variable-speed transmission, the motor being attached to the constant-speed shaft.

Referring to the diagrammatic illustration, a sheave for a round belt is mounted on the variable-speed shaft of the transmission unit at the feed end of the machine and is connected by a crossed belt to a like sheave of the same diameter mounted on a stud in the end of the variable-speed shaft of the transmission unit at the delivery end. The driven sheave runs idly on the stud and in the oposite direction from that of the driving sheave and from that of the stud.

An indicating device on the variable-speed shaft of the transmission unit at the delivery end of the machine consists of the steel collar *A* of a ball thrust-bearing attached to the idle sheave; the brass indicating wheel *B* mounted on the ball retainer of a ball thrust-bearing; another collar *C* on the opposite side of the indicating wheel and attached to the head of the stud *D;* and the spring *F* to hold the collars tightly against the balls in the retainer.

The principle of operation is very simple and can be illustrated by an equally simple experiment. If the collars of a ball thrust-bearing be held in the hands, the balls being pressed between them, and the collars revolved in opposite directions at the same speed, the ball retainer will remain stationary. If, however, one collar is held stationary while the other one is revolved, the ball retainer will revolve in the same direction as that of the revolving collar, but at a slower speed. If the collars are revolved in opposite directions and at different speeds, the ball retainer will revolve in the same direction as that of the collar that is revolved the faster, but at a slower speed.

In operation, with both motors running, the operator adjusts the variable-speed unit at the feed end of the machine to the correct speed. If this speed is faster than that at the delivery end, the indicating wheel will revolve in one direction, but if it is slower, the indicating wheel will revolve in the opposite direction. By adjusting the speed of the transmission unit at the delivery end of the machine until the indicating wheel stands still, it is known that both sections of the machine are operating in synchronism.



Where two sections of a machine are independently driven by individual motors and the speeds must be the same, synchronization can be effected by this arrangement

●

SEEN AND HEARD

JOHN R. GODFREY

Gearless Bus Produced in England

According to *Industrial Britain* for December, a Lancashire manufacturer has put into production a motor bus with a hydraulic turbine substituted for the usual gear box. The engine drives a pump wheel in the turbine, which throws the fluid on to the blades which are connected to the drive shaft of the bus.

When the motor is idling the momentum given the fluid is insufficient to move the bus, but as soon as the driver puts his foot on the accelerator the bus begins to move off smoothly. When the bus reaches its normal running speed, the driver pulls back a control lever which puts the bus into direct drive and the turbine comes to rest.

It is claimed that the action is so smooth that the bus can be allowed to run backwards downhill, checked, stopped and propelled forward or backward by the accelerator alone without the slightest shock.

Cutting-off With Abrasive Wheels

When abrasive wheel makers began to advocate using thin wheels for cutting off steel bars, some of us shrugged our shoulders and had visions of broken wheels and damages of all sorts. Most of us have grown accustomed to the idea, as we became educated to the more or less flexible wheels made with different bonding material. But few of us realize the progress that has been made along this line. Think of cutting a $\frac{3}{4}$-in. round tool steel bar in less than 2 seconds, a 1-in. cold rolled bar in 4 seconds, a 1-in. bar of hardened high speed steel in $2\frac{1}{2}$ seconds and $\frac{3}{4}$-in. brass in 1 second. It is also interesting to note that cold rolled takes longer than high speed stock. Wheel life varies in an equally astonishing way, being given as 1,190 cuts for tool steel, 500 for cold rolled, 170 for hardened high speed steel and 380 for brass. Wheels run from 9,000 to 16,000 surface ft. per min. Wheels from 12 to 16 in. in diameter are recommended. Cutting off with abrasive wheels is just one more factor of modern production on which shop men must keep posted.

SHOP EQUIPMENT NEWS

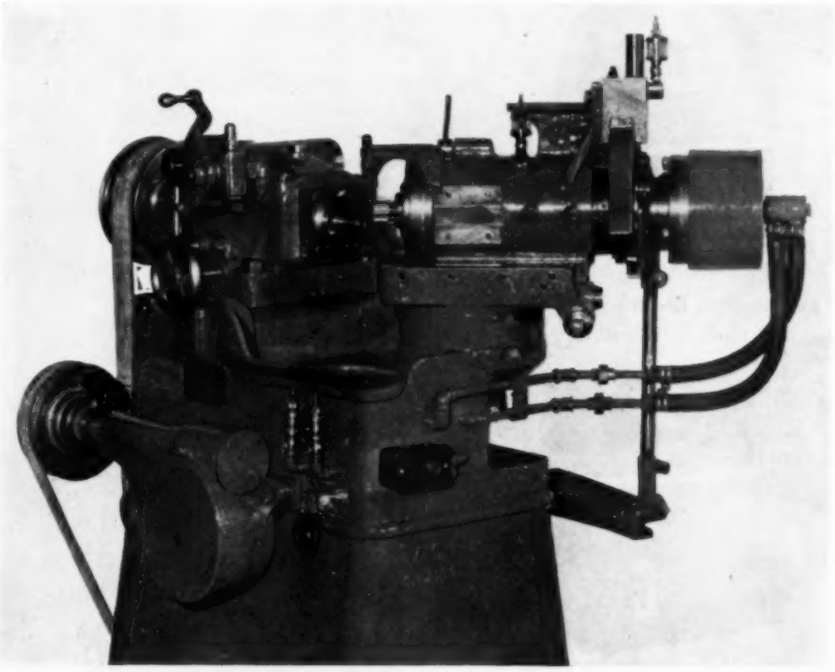
Lipe High-Speed Gear-Tooth Chamfering Machine

W. C. Lipe, Inc., Syracuse, N. Y., has announced an improved model of its gear-tooth chamfering machine, in this case capable of chamfering up to 150 teeth per min. The same principle of operation is employed as on the earlier machines, but a high-speed index and redesigned working parts of the machine make possible the high rate of operation. The improved machine will chamfer all kinds of gears and pinions, such as spur, helical, internal, intermittent, and spiral bevel, and also splines, cutback intermittent teeth. Single- and double-spindle models are built and also a special model for flywheel ring gears.

Improved feed and index cams are employed to provide smoother action of the machine and better finish. The cutter spindle assembly utilizes preloaded ball bearings, and the square sleeve in which the spindle rotates has been increased in size. The rack and pinion for driving the square sleeve are made of heat-treated steel, and the rack is so mounted that it can be turned end-for-end when wear occurs, or it can be replaced without replacing the square sleeve.

A worm feed carriage for the workhead is provided to permit rapid and accurate adjustment of the work when setting up. Precision scales facilitate the setting of various adjustments, and the worm feed carriage has a vernier dial in addition to the scale. Ground teeth are used on the hardened index plate to insure accurate indexing.

Foot-control air valves can be supplied as opitional equipment where maximum speed of operation is required.

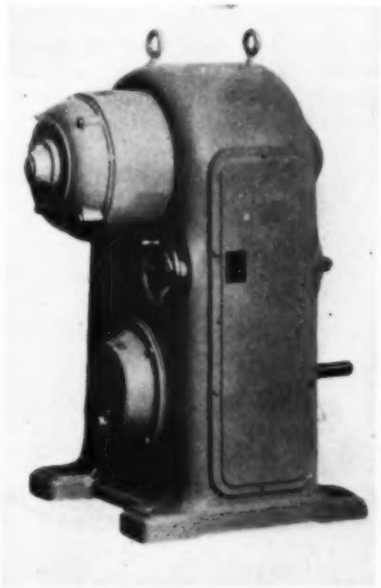


Spur, helical, internal and spiral-bevel gears and pinions, besides splines, can be chamfered on this machine

Sterling "Vari-Speed" Horizontal and Upright Motorized Speed Reducers

Sterling Electric Motors, Inc., Telegraph Road at Atlantic Blvd., Los Angeles, Calif., is now building a line of "Vari-Speed" motors in horizontal and upright designs. The horizontal models are available in open and closed types, whereas the upright type is made in the closed design only. Both closed models are available in ratings up to 15 hp. Standard variations are 2-to-1, 3-to-1 and 4-to-1, and these can be set so that any portion of the variation may be used. Open-type horizontal models are made in sizes up to 25 hp., and pulleys give a standard variation of 2-to-1 and 3-to-1.

The operating principle consists of a heavy, flexible, high-speed V-belt running on two V-pulleys mounted on parallel shafts. Actuation of a small handwheel simultaneously changes the diameter of both pulleys and at the same time automatically maintains the belt at the proper tension. Speed variations of approximately 4-to-1 are provided by the adjustments. These "vari-speed" motors can be built with "Slow Speed" gears integral with the output shafts, thereby providing single or



Sterling "Vari-Speed" Motor of the upright, inclosed design

double reductions giving very slow speeds (down to 5 r.p.m.) or with increasers, giving very high speeds (up to 15,000 r.p.m.).

Improved "Barreled Sunlight"

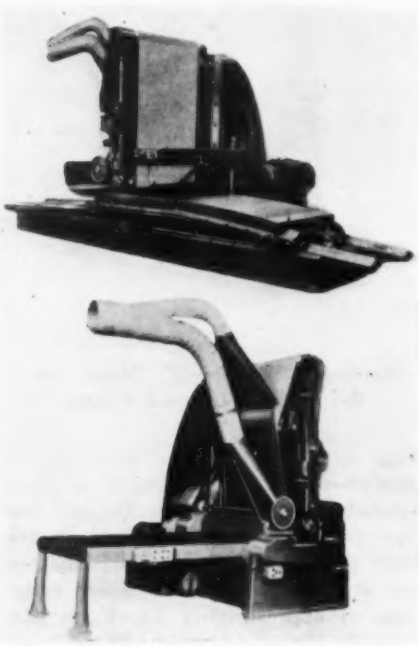
The U. S. Gutta Percha Paint Co., 19 Dudley St., Providence, R. I., is offering its "Barreled Sunlight" paint with five improvements, as follows: Increased light reflecting properties, resistance to "yellowing," spreading power, hiding power and ease of flow. It is claimed that the increased hiding power will often permit the use of a single coat and the increased flowing power is reflected in lowered cost of application. The paint is put up in cans, 5-gal. buckets and large drums.

Mattison Nos. 416 and 418 Abrasive-Belt Sheet Grinders

Any type of alloy, carbon or other sheet can be ground on the abrasive-belt sheet grinders built in two models by the Mattison Machine Works, Rockford, Ill. The accompanying illustration shows the No. 418 reciprocating-table grinder at the top and the No. 416 roll-feed model at the bottom. The latter machine is designed for superficial and rough grinding where one pass under the abrasive is sufficient to clean the surface. This model also lends itself to tandem operation. The reciprocating-table model is designed for finer finishing operations where more than one pass is required. Thin sheets resting on the curved surface of the table are flexed so that buckles are evened out and a flat cross-section is presented to the grinding belt. Because of the short contact at the cutting point, the cut of each grain is shortened, thus breaking up the cuts and preventing long scratches in the work.

The main arm carrying the abrasive grinding belt, driving and idler rolls is vertically adjustable on the column for different thicknesses of material. Belts are quickly changed. The outer side is open so that no bearings or other parts have to be removed for this operation.

Standard sizes of these machines carry belts up to 50 in. wide. The reciprocating-table model grinds sheets up to 48 in. wide and in any length required. The roll-feed model handles sheets up to 48 in. wide and in any length.



Top—Mattison No. 418 Reciprocating-Table Grinder for sheets. Bottom—No. 416 Roll-Feed Model

Simplex Electric Cost and Payroll Recorders

Recognizing that the NRA codes emphasize uniform cost systems and strict attention to the hours of labor, the Simplex Time Recorder Company, Gardner, Mass., has placed on the market an electric cost recorder and an electric payroll recorder. The cost recorder, Fig. 1, has an all-steel case and is arranged to fit any cost system. It will accommodate time cards, job tickets or slips of any length or width. One of the features of this machine is the printing of the day or week or date of the month in a different color, which makes it easier to compute the elapsed time.

In Fig. 2 is shown the payroll recorder which is fully automatic and is furnished in an all-steel case. The movement is driven by a Telechron electric clock.

Fig. 1—Simplex Electric Cost Recorder

Fig. 2—Simplex Electric Payroll Recorder

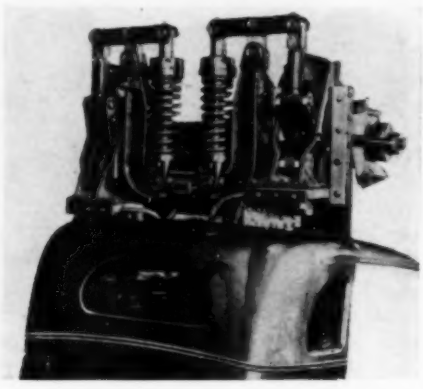
Brown & Sharpe No. 726-A Dial Gage

The Brown & Sharpe Mfg. Co., Providence, R. I., announces a dial gage No. 726-A, graduated to 0.0001 in., and equipped with jewelled bearings. This indicator is especially designed for use on the company's No. 731 and 731-A dial test indicators (*AM*—Vol. 78, page 328).

The dial gage 726-A is designed for use where inspection and testing are required to a finer degree of accuracy. The point of the gage is removable and points of different forms and lengths can be used. Dial face may be turned to bring the zero under the index pointer. The dial is $2\frac{7}{32}$ in. in diameter and has a 0.020 in. spindle movement. The lug on the back has a $\frac{3}{8}$ in. hole.

Thomson-Gibb Special Projection Welding Press

A two-head, double-stroke, projection welding press was recently developed by the Thomson-Gibb Electric Welding Co., 164 Pleasant St., Lynn, Mass., for the purpose of welding two gusset plates to the top rail and back panel of an automobile body. Sixteen projection welds were made with each stroke, or 32 welds with each revolution of the crank. The press utilizes a powerful toggle action and is equipped with quick-changing dies faced with Elkonite inserts.



Illinois Gear-Checking Machines

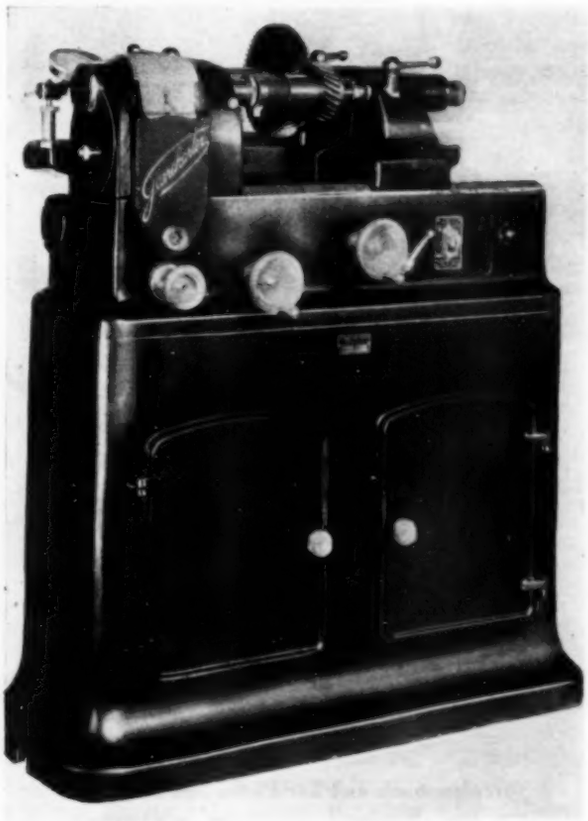
The Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill., has developed three machines for inspection of gears. These units are as follows: The gear charting machine, Fig. 1; the normal pitch and space measuring machine, Fig. 2; and the involute profile measuring machine, Fig. 3.

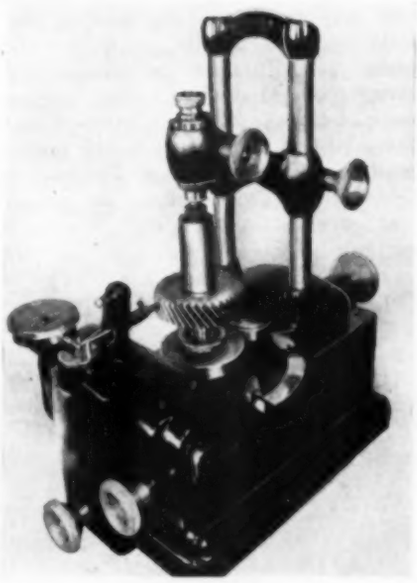
The gear charter shows combined errors of tooth profile, tooth spacing, interference and eccentricity. Each error can be separated from the others and analyzed. This is possible because the gears can be rolled by hand and any tooth profile error, interference, or jump per tooth, may be observed on an indicator. Also the gears can be set at correct center distance and rotational backlash measured with an indicator. After these various hand tests are made and each error observed, the gears may be rotated by power and a chart made which records the combined discrepancies. Thus, records can be set for subsequent setups on gear production. Comparisons can also be made between a "green" gear and its condition after hardening. Centers on the machine are adjustable and center distances are quickly obtained by inserting a gage between the hubs on the front and the back headstocks. Dimensions of the machine are: height, 45 in.; length, 40 in.; width, 19 in. The weight is 1,050 lb.

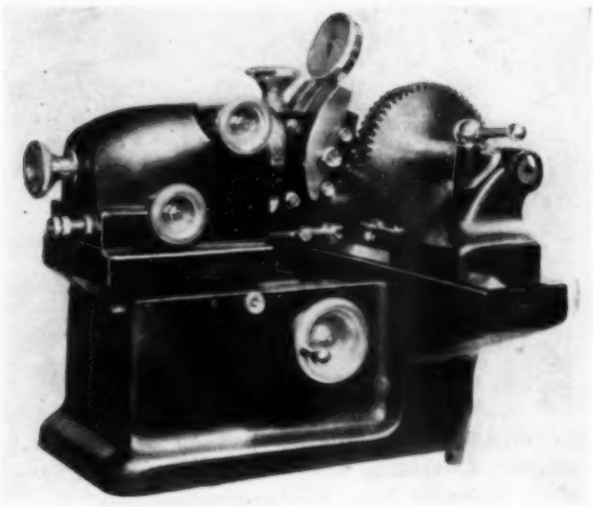
The normal pitch and space measuring machine is designed to measure normal pitch in the rotational plane of gears and to check spacing in various types of gears in planes other than rotational. The operation is semi-automatic, and the average automobile, truck or tractor gear of 30 teeth may be checked in one minute. This machine may be used on its own bed or it may be clamped to any machine that has a pair of centers. It may also be attached to worm- and bevel-gear cutting machines, and the gears checked on their own work arbors.

The normal pitch and space measuring machine can be used for spur, helical, worm and bevel gears. To check the normal pitch of involute of a helical gear, it is necessary to have the contact fingers of the measuring machine stand in the rotational or transverse plane, wihch is perpendicular to the axis of the gear. In order that the contact fingers may be set tangent to the base circle, so that they contact on the line of pressure, a base circle is employed. This base circle is placed between centers and the outer surface of the contact fingers are brought up until they touch the base circle. The inward stop on the head is adjusted to maintain them in this position. The fingers may then be moved upon their slide until they are in position to contact two adjacent teeth. A micrometer may be used for measuring distance between the contact fingers. To check the normal circular pitch of the helical teeth on the gear, the head is turned to the helix angle.

Gears up to 10 in. in diameter and those having shafts up to 13 in. between centers, are within the capacity of the involute profile measuring machine. Cluster gears and gears integral on the shaft can be reached by moving the indicator slide to the desired position. A base circle must be made up for each different gear to be checked. A base circle is placed on the lower spindle below the gear and brought up against the straight edge. Then the work is placed between the centers and the contact finger put into position. When the contact finger is just starting to check the gear profile the sector finger is set at zero on the sector. The sector is







Left — Gear-charting machine that permits hand checking or power charting. Below—Normal-pitch and space measuring machine that checks spur, helical, bevel and worm gears. Right—Involute profile checking machine.

graduated to 360 deg., and therefore the involute curve may be divided into degree increments. Deviations from the standard involute curve are shown from the dial gage.

J&L Stationary-Type Tangent Dieheads

Pull-off type, stationary, tangent dieheads are now available from the Jones & Lamson Machine Co., Springfield, Vt. Five sizes are built in a threading range from No. 8-32 to 2 in. in diameter. Chaser holders are ground and lapped on the dovetails, and can be changed without disassembling the die. Chasers are ground in the thread and are interchangeable in revolving and stationary dies of the same capacity. Only one set of chaser holders is required for any right-hand thread within the rated die capacity, whether standard or special, and regardless of the diameter or pitch.

These dies are locked by pushing the locking lever handle in one direction, and may be tripped by pushing the lever in the opposite direction. To make pitch-diameter adjustments a spring-operated pawl, *A*, which engages teeth on the adjusting nut, is raised, and the adjusting nut moved to the proper position. After adjustment the pawl is permitted to drop back in the proper tooth where it locks the nut. The teeth on the adjusting nut permit adjustments to one-quarter thousandth, and in addition to this, the die plate is provided with graduations reading to one-thousandth inch.

These dies are equipped with two springs set up under a predetermined pressure to permit a cushion start as shown at *B*, thus eliminating impact of the chasers and work. Dies are also provided with longitudinal float as shown at *C*. A driving flange is screwed on to the shank and dowelled in place, thus affording a drive at a point farthest from the center of the die. This driving arrangement also permits eccentric float *D* to take care of misalignment of the die and work. The amount of eccentric float is determined by the clearance allowed between the outside diameter of a shank integral with the die body and the bore of the outer shank sleeve. By controlling the float in the shank, the face of the die remains more nearly at right angles to the center of the work than is possible when provision for float is confined to a shorter distance.

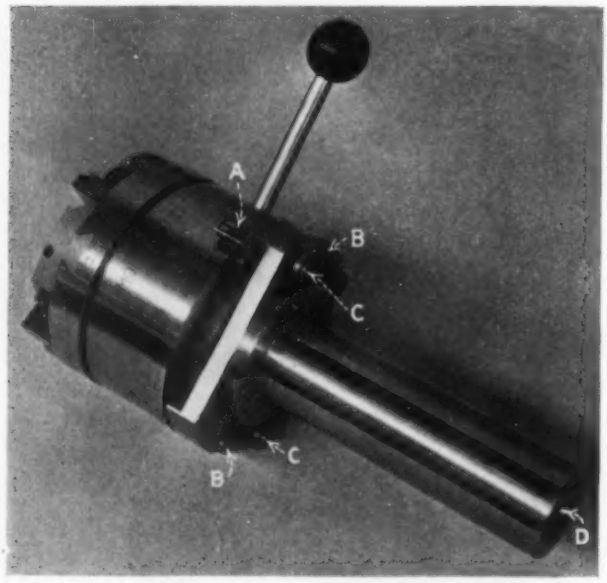
Wardwell Combination Automatic Saw Grinder

A fully automatic, combination automatic saw grinder in bench or pedestal types is offered by The Wardwell Manufacturing Co., 3167 Fulton Road, Cleveland, Ohio, for grinding circular, hack and band saws, either for wood or for metal. Three speeds of operation are provided, grinding from 30 to 75 teeth per min. Double feed-pawl fingers, one on each side of the grinding wheel, assure continuous advance of the saw, even though the teeth are broken or filled with metal. One universal cam permits of following any shape of tooth with the grinding wheel, whether straight or curved back. After regrinding, a land or flat may be put on each tooth.

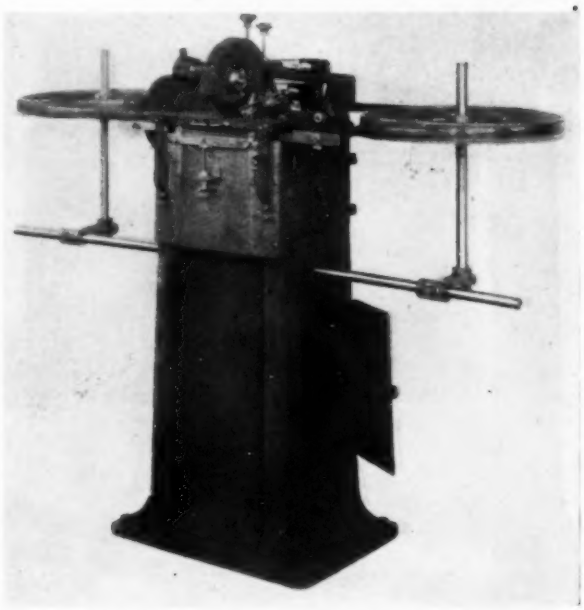
The grinding wheel has two speeds, so that when the wheel becomes worn down to a smaller diameter, the speed may be stepped up and the correct speed for sharpening maintained. An 8-in. wheel is employed.

"Triple S" Industrial Grease Gun

A portable industrial grease gun and tank for greasing jobs about the plant has been developed by the Specialty Sales and Service Corp., 138 Holden St., Minneapolis, Minn. As shown, the tank holding 10 lb. of grease is carried on the operator's back by means of straps, and a sufficient length of hose is provided to operate the gun. The tank is filled three-quarters full of grease and then charged with air at 100 to 125 lb. pressure. One filling of air empties the tank of grease, and this tank can be pumped up with a hand pump if necessary. In operation, grease comes up to the gun head under pressure from the tank. By working the



J&L Stationary-Type Tangent Diehead with following features: *A*—Locking pawl. *B*—Cushion start. *D*—Eccentric float. *C*—Longitudinal float.

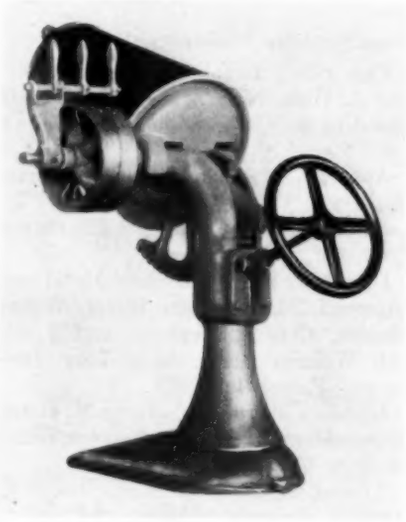


Circular, hack and band saws can be ground on this Wardwell automatic saw grinder

handle the operator causes the pressure to be built up in the piston chamber and sends the grease out in the gun head. When resistance is met, the gun head develops sufficient pressure to fill the tightest bearing. Various attachments can be furnished.

Globe Tilting Tumbling Barrels

The Globe Machine & Stamping Co., 1200-1250 West 76th St., Cleveland, Ohio, has redesigned its line of tilting-type tumbling barrels. The line now consists of five sizes. The "Work Shifting" bottom is a one-piece casting that fits into the bottom of the shell



and forces the load to move forward and backward. Since the load is also rotated constantly, the triple action affords greater speed and uniformity of finish. Roller bearings are employed on the machine. A redesigned base, stand, gear guard, pulleys and shifter bracket increase the rigidity for the machine.

Littell No. 3 Automatic Centering Reel for Coil Stock

The F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill., has added the No. 3 automatic centering reel with a capacity for 300 lb. of coil stock. This reel is equipped with ball bearings for easy running, and the automatic centering arms keep the coil in balance, regardless of the size of the center hole in the coil. A loading bar makes it practicable for one man to load the reel, because the self-centering arms

can be quickly reduced in diameter and the spindle can be locked to prevent turning. It is said that the reel can be loaded and the coil centered in one minute. A stock-support arm at the bottom of the reel permits running with a loose loop without danger of the stock tangling with the reel arm. All important parts of the reel are made of steel or malleable iron to prevent breakage. Motor drive can be furnished.

Chase "Olympic" Bronze

"Olympic" bronze is available from the Chase Brass & Copper Co., Inc., Waterbury, Conn., in three types: Type A for hot-rolled and cold-rolled forms; Type B for free turning wire and rod; Type C for castings. Type A is said to be readily cold-rolled to 75 per cent reduction in thickness without becoming brittle. Forges at a temperature of 1650 deg. F., flowing 70 to 90 per cent as much as brass at 1,450 F. Machinability said to be slightly better than hard copper, except Type B which it is claimed can be run in automatic screw machines at ⅔ the speed used for free-cutting brass rod. Type C is recommended for high strength sand castings, particularly for fine detail work. Approximate strengths in various forms are said to be:

Form	Tensile Strength Lb. per Sq.In.
Hard-drawn wire	150,000
Hard-drawn sheet	115,000
Bolt stock	90,000
Forged	60,000
Sand castings	40,000

Type A available in strip, sheet or plate in any temper. Types A and B also available in rod and wire sizes from 0.020 to 4 in. in diameter in any temper. Type C supplied in form of castings or ingots. Chase Brass & Copper Co., Inc., Waterbury, Conn.

• TRADE • PUBLICATIONS

BALL BEARINGS. The Fafnir Bearing Co., New Britain, Conn., has issued a folder, "Lubrication of Ball Bearings," which discusses in detail the lubrication of ball bearings as applied to various types of machinery.

BELT CONVEYOR IDLERS. Bulletin No. 72, issued by The C. O. Bartlett & Snow Co., Cleveland, Ohio, discusses belt-conveyor idlers manufactured, together with tables dimensions and prices, and engineering data relative to proper spacing, capacity and angles of incline.

BRONZE. A catalog on its "Olympic" bronze is now available from the Chase Brass & Copper Co. Inc., Waterbury, Conn. The material is a high copper alloy containing silicon and zinc. Very complete information is given on fabrication, and tensile, mechanical, physical and electrical properties.

COMPRESSORS. The Gardner-Denver Co., Quincy, Ill., has issued two bulletins on compressors: Bulletin AC-7 on vertical, single- and double-stage, air-cooled compressors and outfits; Bulletin HAC-36 on duplex horizontal compressors for large industrial application.

COUPLINGS. A folder, "Poole Flexible Couplings for 1934," shows the improvements that have been made in this standard item by the Poole Foundry & Machine Co., Woodbury, Baltimore, Md.

ENGINE BEARINGS. Federal-Mogul Corp., 4809 John R. St., Detroit, Mich., has published a booklet "Automobile Engine Bearings and How To Service Them" by L. C. Blomstrom, chief engineer. The booklet is a complete technical exposition of the replacement of engine bearings and discusses in detail many installation kinks.

FIBRE SHEETS. Engineering data on the fibre sheets produced by the Spaulding Fibre Co., Inc., Tonawanda, N. Y., are contained in a four-page circular.

GALVANIZED SHEETS. "Republic Galvannealed Sheets" is the title of a folder issued by the Republic Steel Corp., Youngstown, Ohio, that explains the metallurgical reasons for superior adherence of zinc coating on the company's products and describes the characteristics of these sheets. A table of gages and sizes is furnished.

GENERATORS. Type B, d.c. generators and exciters from 1 to 5 kw. are shown in Bulletin GEA-1607-A, published by the General Electric Co., Schenectady, N. Y.

GRINDERS. The Norton Co., Worcester, Mass., has printed Form 2236 on a No. 1 tool and cutter grinder, and Form 2237 on the 6x18-in. hydraulic surface grinder.

HOLLOW-HEAD SCREWS. The products of the Allen Mfg. Co., Hartford, Conn., are shown in a recent catalog. These products are hollow setscrews, socket-head capscrews, socket-head stripper bolts, pipe plugs, and tap extensions. The screws are made of chrome-molybdenum steel, as well as other materials. Applications, dimensions, list prices, and engineering information make up the catalog.

MOTORS. Bulletin No. 167, Part 8, issued by the Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo., discusses Tyle RD, d.c. motors of the compound-wound type, and describes thoroughly the construction details.

POWER TRANSMISSION PRODUCTS. The Boston Gear Works, Inc., 151 Lafayette St., New York, N. Y., has issued a pocket-size Catalog 50 showing gears, speed reducers, chain drives, ball bearings, couplings, universal joints and other power-transmission products.

PROJECTION APPARATUS. Catalog No. 577, distributed by the R. Y. Ferner Co., 930 Investment Bldg., Washington, D. C., American agents of the Société Genevoise d'Instruments de Physique, Switzerland, describes a desk-type projection apparatus for inspection, measurement and photography of small manufactured articles and various types of materials.

REBUILT MACHINES. The service rendered by the Motch & Merryweather Machinery Co., of Cleveland, Detroit, Cincinnati and Pittsburgh, in supplying rebuilt machine tools and other machinery is mentioned in a recent catalog. A description is given of the reconditioning methods, and there is a complete list of rebuilt machine tools in stock.

SHIMS. The Laminated Shim Co., Inc., 2124 Forty-Fourth Ave., Long Island City, N. Y., has printed a booklet on "Laminum" shims made of laminated brass which may be peeled individually for adjustment. Shims are made in many varieties and may be obtained to special order.

STAINLESS STEEL. "Enduro 18-8 Stainless Steel" is the title of a booklet released by the Republic Steel Corp., Central Alloy Division, Massillon, Ohio. This 16-page brochure contains data on the above material as well as several of the more important variations. A table of laboratory corrosion data lists the degree of corrosion-resistance of 18-8 stainless, Enduro AA and Enduro S to each of more than three hundred chemical reagents, solutions and products.

TEMPERATURE CONTROLS. Form 85-10 prepared by the Brown Instrument Co., Philadelphia, Pa., illustrates the importance of automatic temperature control, and mentions the company's temperature controlling instruments.

VERTICAL MOTORS. Bulletin 174, issued by the Wagner Electric Corp., 6444 Plymouth Ave., St. Louis, Mo., illustrates three different types of vertical motors and shows how horizontal-type motors can be mounted vertically to save the cost of special vertical construction.

WRENCHES. A catalog describing complete lines of open-end, box, socket, pipe and special wrenches for hand or power use is being distributed by the Bonney Forge & Tool Works, Allentown, Pa., as Catalog No. 34A.

ENGINE FUEL. The Philgas Co., General Motors Bldg., Detroit, Mich., has published bulletin No. 38 on liquefied petroleum gases for block testing.

• PATENTS •

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Metal-Working Machinery

Grinding Machine. Gerard A. De Vlieg, Rockford, Ill. Patent 1,956,983.

Magazine Feed for Single Spindle Machines. Harry W. Rupple, Shaker Heights, Ohio, assigned to the Cleveland Automatic Machine Co. Patent 1,956,999.

Drop Hammer. Arthur Schneider, Dusseldorf, Germany, assigned to Eumuco Aktiengesellschaft fur Maschinenbau, Leverkusen—Schlebusch, Germany. Patent 1,957,021.

Machine Tool for Generating the Teeth of Bevel Gears. Albrecht Maurer, Bad Homburg Vor der Hohe, Germany. Patent 1,957,028.

Cutter Relieving Lathe. Robert D. Shaw, Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,957,296.

Machine Tool Transmission and Control. Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,957,310.

Tap Grinder. Clayton R. Burt and Frank O. Hoagland, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,957,317.

Tools and Attachments

Engaging and Desengaging Device for Presses, Stamping Machines, and Similar Machine Tools. Wilhelm Schmidt, Erfurt, Germany. Patent 1,956,658.

Hydraulic Press Operating Circuits. Walter Ernst, Mount Gilead, Ohio, assigned to the Hydraulic Press Manufacturing Co. Patent 1,956,758.

Caliper Attachment for Outside Micrometer Calipers. Edwin Mayman, San Diego, Calif. Patent 1,956,871.

Indexing Device. Joseph Verderber, Cleveland, Ohio, assigned to Cleveland Universal Jig Co. Patent 1,956,883.

Drop Hammer. Frank J. Vlchek, Cleveland, Ohio, assigned to the Vlchek Tool Co. Patent 1,956,885.

Antifriction Mounting for Lathe Centers. John H. Baninger, Bristol, Conn., assigned to General Motors Corp. Patent 1,957,057.

Swaged Pusher and Method of Making the Same. Charlie William Simpson Windsor, Vt., assigned to the National Acme Co. Patent 1,957,235.

Inserted Blade Cutter. Frank P. Miller and Lewis Skeel, Meadville, Pa., assigned to McCrosky Tool Corp. Patent 1,957,348.

MAY 8, 1934

Metal-Working Machinery

Cam Shaft Lapping Machine. Herbert J. Wills, Niagara Falls, N. Y., assigned to the Carborundum Co. Patent 1,957,568.

Apparatus for Lapping or Grinding. Herbert J. Wills, Niagara Falls, N. Y., assigned to the Carborundum Co. Patent 1,957,569.

Chip-Flow Lathe for Hard-Metal and Diamond Tools. Malte Ritter, Walter Mobius, Otto Rothenberg, and Freidrich Wilhelm Block, Magdeburg, Germany. Patent 1,957,667.

Grinding Machinery. Lewis R. Heim, Mount Dora, Fla., assigned to the Heald Machine Co. Patent 1,958,001.

Thread Grinding Machine. Oscar E. Koehler, Greenfield, Mass., assigned to Greenfield Tap & Die Corp. Patent 1,958,105.

Shaper and Power Transmitting Mechanism Therefor. Ernest R. Llewellyn, Arlington, Mass., and George H. Higgins, Torrington, Conn., assigned to the Hendey Machine Co. Patent 1,958,106.

Tools and Attachments

Safety Device for Punch Presses. Bert H. Hawkins, Royal Oak, Mich., assigned to McCord Radiator & Manufacturing Co. Patent 1,957,835.

Power Press and the Like (Guard). James Alexander Thomson Napier, London, England, assigned to Edwin James Hall and Hugh John Hall, both of London, England. Patent 1,958,151.

Means for Forming the Banjo and Frame of a Rear Axle Housing. George Spatta, Buchanan, Mich., assigned to Clark Equipment Co. Patent 1,958,214.

Processes

Method of Forming the Banjo and Frame of a Rear Axle Housing. George Patta, Buchanan, Mich., assigned to Clark Equipment Co. Patent 1,958,215.